Montana Outdoors

March/April 1978
One Dollar

Montana Outdoors March/April 1978, Vol. 9, No. 2

2 **At Home with the Prairie Dog**
This little rodent, important in several ecological relationships, can be controversial. by Dennis Flath

9 **Weed Control**
"A Weed is a Weed is a Weed...or is It?" by John Weigand and "The Biological Control of Weeds" by Jim Story

15 **The Catchall**

18 **Contributors**

19 **Winter Scenes**
A series of color photographs of a Montana winter, accompanied by four *haiku*

27 **Dear F&G**

28 **The Wily, Wild Dog**
Philip Schladweiler updates readers on the department's coyote/big game research

31 **Is There a Bigfoot?**
Three authors with different opinions explore this intriguing question: Vern Craig, Dr. Grover Krantz, Dr. W. Leslie Pengelly

35 **Snake Pit Receives Permit**
The final frame in our cartoon series. illustrated by Vern Craig

36 **Tracking the Wild Ones**
How biologists use telemetry to study animal populations. by Ken Walcheck

44 **Ghostly Wanderer from the North**
Ken Walcheck explores the life history of the snowy owl and the large, white predator's relationship with the lemming

Thomas L. Judge/*Governor, State of Montana*

Joseph J. Klabunde/*Chairman, Fish and Game Commission*

Commission Members:
Spencer S. Hegstad/*Vice Chairman*
Alfred L. Bishop
Arthur C. Hagenston
Land M. Lindbergh

Dept. of Fish and Game
Robert F. Wambach/*Director*
Fletcher E. Newby/*Deputy Director*
Orville W. Lewis/*Associate Director*

Bill Schneider/*Editor*
Kay Ellerhoff/*Associate Editor*
Marty Beatty/*Circulation Director*
Donita Sexton/*Art Director*
Vern Craig/*Artist*
Tom Warren/*Photographer*
Craig Sharpe/*Photographer*

THE COVER: To some, the prairie dog represents ecological diversity and stability. To others, it means unwanted competition for grass land vegetation. Read about this busy rodent, beginning on page 2 (front cover photo: Vince Claerhout). The National Wildlife Federation, the nation's largest citizens' organization working for the welfare of wildlife, has provided the back cover photo of the peregrine falcon (photo: David Hancock).

Montana Outdoors, the official publication of the Montana Dept. of Fish and Game, is published six times each year (January, March, May, July, September and November). Contributions (manuscripts or illustrations) are welcome with the understanding that the department or the editor cannot be responsible for loss or damage. All contributions will be published at the discretion of the editor. Subscription rates are $3 for one year, $5.50 for two years, $8 for three years and $2.50 for each additional year. (Please add $2 per year for foreign subscriptions, excluding Canada.) Individual copies are available at newsstands and regional department offices. Price per copy is $1. Although *Montana Outdoors* is copyrighted, permission to reprint articles is available by writing our office or phoning us at 406/449-2474. All correspondence should be addressed: *Montana Outdoors*, Dept. of Fish and Game, 1420 E. Sixth; Helena, MT 59601. ©Montana Dept. of Fish and Game 1978. All rights reserved.

Postmaster: Second class postage paid at Helena, MT 59601 and additional mailing offices.

The Director's Column

Department and commission concern about landowner/recreationist problems and the severity of access restrictions in Montana has recently received considerable emphasis. Hopefully, most people now understand that we are firmly committed to doing something about these conflicts. In fact, this constitutes our department's top-priority project.

The department and commission have long recognized the need for better relations between landowners and recreationists. Through the years, we have attempted to do the more obvious things—education of young people in the hunter safety program, articles and other information written for use in the news media, general encouragement of courtesy on the part of recreationists when dealing with landowners and awareness by recreationists that use of private land is a privilege and not a right. But with recent increases in hunting pressure resulting in additional closure of private lands, we realized this approach was no longer enough.

So a citizens' advisory group was created. Officially known as the Landowner Relations/Sportsmen Access Advisory Council, it became a reality in late December when Gov. Thomas L. Judge made the official appointments:

Don Bailey, Forsyth rancher

William M. Day, Glendive state representative and rancher

Joe Etchart, Glasgow rancher

Kenneth A. Fitzpatrick, Butte businessman

Jack E. Galt, Martinsdale state senator and rancher

John Gilpatrick, Hilger rancher

Don Hartman, Miles City rancher

Floyd C. Kimmel, Billings contractor representing the Southeastern Sportsmen's Assn. (F.B. Carver and Greg Maxwell from the same organization are his alternates.)

Joe Klabunde, Billings, chairman of the Fish and Game Commission

John Poston, Helena attorney

S.J. Seidensticker, Twin Bridges rancher

In early January, the council conducted its organizational meeting, and in mid-February, members again met in Helena, this time for a two-day "brain storming session." During both meetings, the group displayed one common trait: enthusiasm about trying to develop realistic solutions to access and landowner/recreationist problems. Obviously, members have an intense interest in this problem or they would not take time from their busy lives to work—without pay—on the advisory council. Hopefully, they will receive the recognition they deserve.

At the first council meeting, one member asked, "Just how much authority do we have?" In response, I stated the purpose of the council is to advise and assist the department and commission in improving relations between landowners and recreationists and to help resolve the access problems causing closure of private and public land to use by recreationists. In other words, the authority of the council is advisory in nature. However, the department and commission will be obligated to make every effort to implement council recommendations.

The council has a big assignment. But with the priority given this by the department and commission and with suggestions from outside the council as well as from other landowners and sportsmen everywhere, we're optimistic about designing an effective program resulting in a faster rate of improvement in the vital relationship between landowners and recreationists.

Robert F. Wambach

The black-tailed prairie dog (facing page) is much more abundant in Montana than the state's other species, the white-tailed prairie dog. photo: Harry Engels. Prairie dog towns (left), which can stretch for miles, are often scorned by ranchers who feel the pesky rodents compete with livestock for vegetation. photo: Vince Claerhout. Born underground, prairie dog pups (below), which usually number about five per litter, begin foraging above ground at about five weeks of age. photo: Harry Engels

At Home with the Prairie Dog

by Dennis Flath

LIFE IN A PRAIRIE DOG TOWN is fascinating. The little animals scurry everywhere, busying themselves with household chores, gathering food, keeping each other on the alert for predators and defending their neighborhood rights. In between these self-imposed responsibilities, pups wrestle and play, occasionally getting into trouble with

FIGURE 1—range of the black-tailed prairie dog

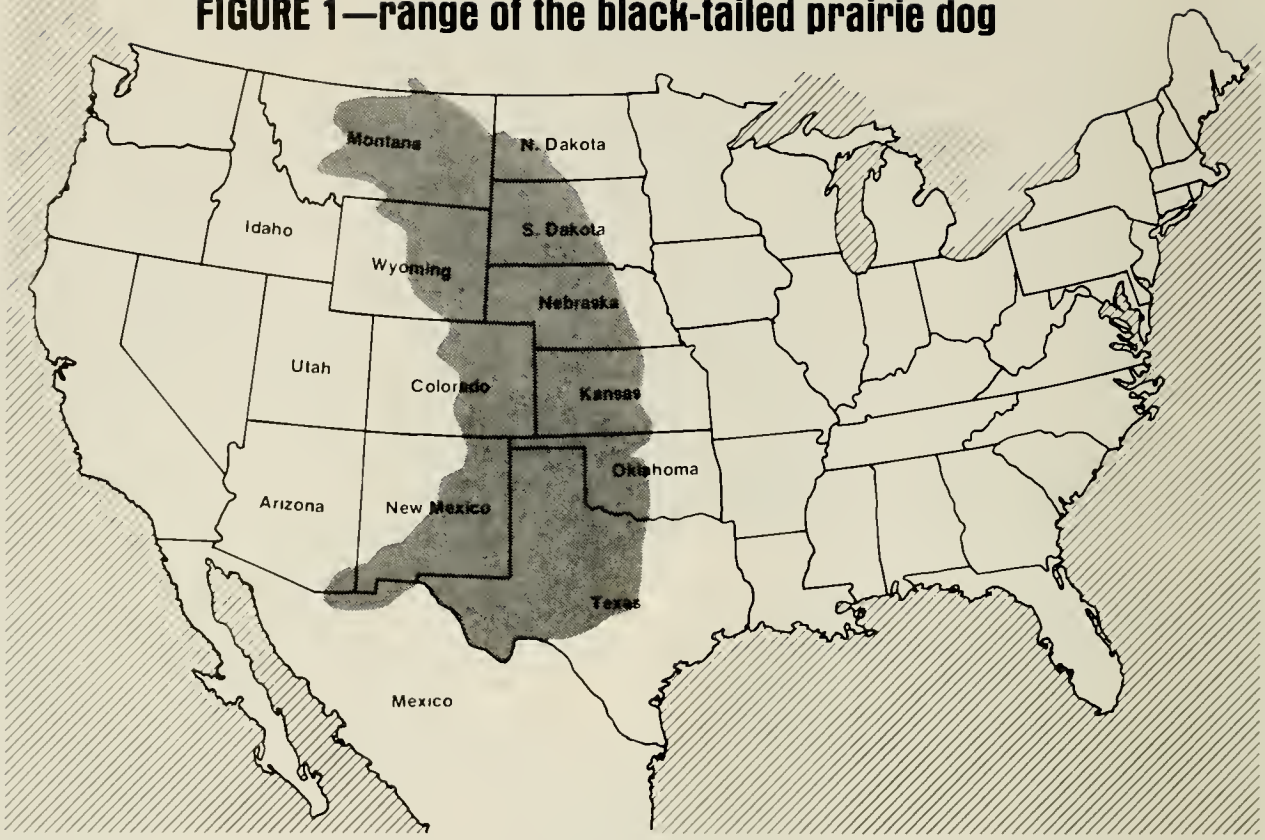
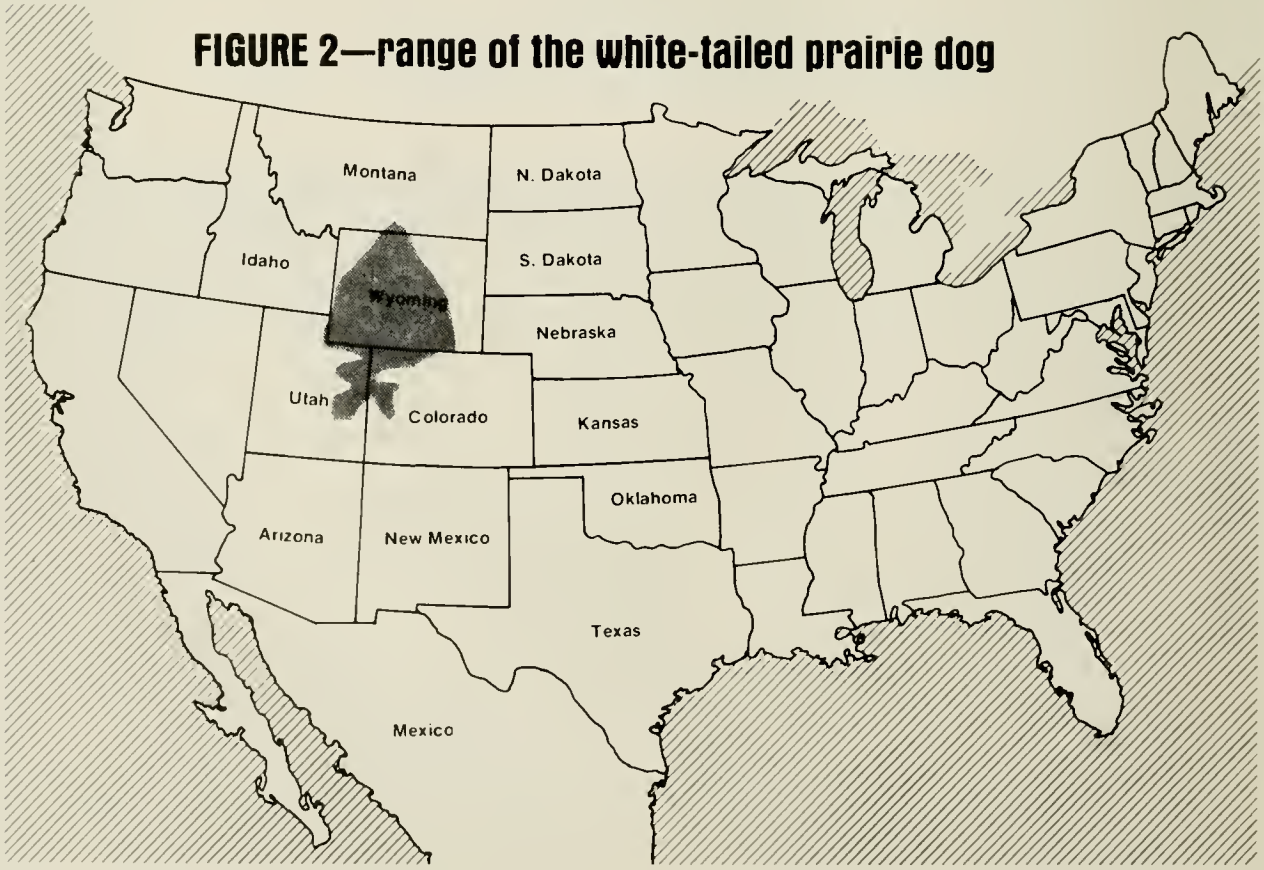


FIGURE 2—range of the white-tailed prairie dog



the neighbors. A dog town is a world of activity unique to North America's short and mixed grass prairies.

Of five species of prairie dogs occurring in North America, two inhabit Montana. The black-tailed prairie dog *(Cynomys ludovicianus)* inhabits a wide belt extending from Canada to Mexico (Figure 1); this species is common to much of eastern Montana. On the other hand, the white-tailed prairie dog *(Cynomys leucurus)*, is more restricted in its distribution (Figure 2). In Montana, it is found only in the southern portion of Carbon County, south of Bridger.

Habits of the two species are as different as the color of their tails. White-tailed prairie dogs "go under" for a long hibernation. In fact, they actually spend more time hibernating than they spend in an active state. Adult males emerge from hibernation about the first of March, followed two weeks later by adult females. Yearlings follow in about another week. After emerging, the dogs occupy themselves with burrow maintenance. They apparently breed soon after the females emerge from hibernation, in late March or early April.

Near the first of May, pups are born. They spend several weeks in the burrow before coming out to see the world. Most observers indicate pups are first seen above ground in early June. In Carbon County, however, observers have spotted pups above ground as early as May 22. Litters average 5.5 pups for most populations, with litters ranging from 2-8; litters with more than 7 pups are rare. Of 49 observations of litters in Carbon County during 1977, 2 contained 7 pups and only 1 contained 8.

During June and July, litters of pups begin foraging above ground. At this time, litter mates stick together. This cohesion begins to disappear by late July when bonds with adults are also apparently severed.

In early August (sometimes late July) adult males begin hibernating. Adult females follow in mid-August, but juveniles remain active until about the end of October before entering their burrows for the winter. "Pioneering," or town expansion, takes place from September-October, when juveniles form the only active segment of white-tailed prairie dog colonies. The young prairie dogs move to the "city limits" and dig new burrows. Often, young dogs pack up and leave, emigrating to a new site two or three miles away before taking up residence. They may also dig new burrows within confines of the town.

Emigration of white-tailed prairie dogs plays an important role in a colony's population dynamics. Not only does this phenomenon result in new towns, but it also keeps colony size down. Emigration allows prairie dogs to change towns, so some towns grow faster than normally attributable to reproduction. Similarly, some towns stabilize or shrink, even though pup production is normal. This controls population levels to varying extents, since transient dogs are more susceptible to predation than those which remain in their original colony. Emigration and immigration also spread disease and parasites.

White-tailed prairie dog colonies seldom exceed 100 acres. In fact, colonies in Montana average 20-60 acres. These colonies appear poorly organized, with small towns appearing to be a collection of miscellaneous burrows. Burrow spacing is far from uniform, with some burrows built in clusters. From six to twelve burrows lie close to one another, with as much as 150 yards of communal property between clusters. Other towns exhibit a wider, more even burrow spacing. Biologists don't understand the reasons for the variations, but they apparently have nothing to do with territoriality.

When visiting a colony, observers rarely see more than a dozen dogs at one time. Since the population density of whitetails averages only one or two dogs per acre and the animals tend toward shyness, opportunities for predation are reduced. Tall vegetation reduces visibility in some towns—a situation completely unacceptable to blacktails. When disturbed, whitetails emit a rapid series of low "buk-buk-buk-buk-buk-buk" barks to announce possible danger.

While mounds formed by the underground burrows of black-tailed prairie dogs tend to be somewhat uniform, those of white-tailed prairie dogs aren't. Some whitetail mounds are barely visible, while others are huge. The largest whitetail mound found in Carbon County was 26 feet long, 20 feet wide and 2 feet high. However, the mound of a white-tailed prairie dog burrow rarely exceeds 15 feet in diameter.

THE BLACK-TAILED PRAIRIE DOG is characterized by the towns in which it lives. These towns are a series of earthen mounds which rise several inches to a foot above ground level. Some towns in Montana stretch for several miles, although they seldom exceed 400-500 acres. To anyone viewing such a colony, one thing is immediately apparent: short vegetation. Black-tailed prairie dogs, unlike their white-tailed cousins, are downright intolerant of anything that blocks their view. Stands of sagebrush and, in some cases, tall stands of grass restrict expansion of black-tailed prairie dog towns.

Black-tailed prairie dogs carefully construct the mounds of their burrows. Not only do the mounds serve as "watching posts," but they also keep running water out of the burrow system. The blacktails carefully shape and pack their mounds, in contrast to the somewhat messy piles of dirt which characterize mounds of the white-tailed species.

Topsoil from around the mound is pulled in toward the mound and mixed with excavated subsoil. Such soil mixing complements soil richness. Prairie dog digging also aerates the soil and allows air and moisture to penetrate through the tunnels. Since population densities usually average from five to fifteen blacktails per acre, their digging over many years can substantially enrich the soil. However, soil

enrichment won't be apparent while prairie dogs occupy the site.

Litters of black-tailed prairie dogs are born in April and generally appear above ground in mid-May. Litters range from two to ten pups and average slightly less than five. It takes awhile for pups to learn the social intricacies of prairie dog life, and frequently they are taught lessons by neighboring prairie dogs about staying within their own territory. Lessons are sometimes harsh, but necessary, to insure that "proper" behavior is passed on to the next generation.

Black-tailed prairie dog adults expand the towns. When juveniles are nearly adult size, older animals leave home burrows to the youngsters and move to the periphery of the town to construct new burrows. Emigration to an entirely new area is not as common among black-tailed dogs as it is among the white-tailed species.

Establishing new towns or expanding old blacktail towns depends on the availability of suitable short grass sites. Before the advent of white man and his livestock, grazing and trampling by vast herds of bison provided many suitable sites for prairie dogs. Eventually, bison were replaced by cattle, horses and sheep. Sites which were (and are) most heavily grazed provide prairie dogs with the best opportunities to increase their numbers. Once a short grass site is occupied by dogs, they do their best to keep vegetation short. When taller grasses or forbs encroach on the town, prairie dogs get busy and cut them down. An unobstructed view is critical to the blacktails' well-being.

Prairie dog towns are often found near water developments. There's a reason for this: On the Great Plains, where water is valuable, ranchers develop stock ponds and wells to accommodate domestic livestock. Such developments attract and hold livestock, resulting in severe overgrazing in the vicinity. This overgrazed area constitutes an ideal spot for prairie dogs to establish towns.

Black-tailed prairie dogs have an elaborate social organization. The basic social unit is a "coterie," usually consisting of one (rarely two) males, two to four females and their litters of pups. Each coterie possesses its own unique communal territory which is defended against members of neighboring coteries. Members live in complete harmony within a coterie. They never quarrel among themselves, and dominance is often shared. Cooperation is admirable—they help one another with burrow construction, mound maintenance and defense of the territory. Contacts between coterie members are frequent and friendly, including recognition "kissing," grooming and play.

COMMUNICATION AMONG ALL prairie dogs in a particular town is one phenomenon readily apparent to anyone who observes a colony. Most obvious is the alarm call, a sharp "bark" or series of barks accompanied by a flick of the tail. When the dog detects a predator or other danger, the barking starts. It rapidly becomes contagious, spreading across the entire town. Thus warned, dogs cease other activities and run to their mounds. Hundreds of eyes scan the horizon in every direction from the vantage points that mounds offer. The alarm calls continue until the predator's advance causes the dogs to dive into their burrows. Once the danger has passed, the word is spread that everything is okay. The "word" is in the form of a "wee-oo" call, accomplished while standing upright, throwing the front legs outward, nose skyward and arching the back during the final syllable. As the prairie dog drops back to all fours, the second syllable is emitted.

In prairie dog language, the "wee-oo" call probably means something like "I feel secure in my territory." This call is used under a variety of circumstances, including expressions of territoriality, announcing the passing of danger and simply expressing a peaceful situation.

Prairie dogs are opportunistic little rascals when selecting food. As the abundance of the various plants changes in response to grazing, precipitation and the activities of the dogs themselves, the basic food habits of the prairie dogs also change.

Since annual forbs usually account for most plant species present in dog towns, they make up the major portion of the diets. Prairie dogs relish Russian thistle and summer cyprus. Preferred foods include amaranths, cut-leaved nightshade, scarlet globe mallow, pepperweed and knotweed. Prairie dogs feed on pricklypear and are adept at removing the spines with their paws before feeding on the succulent stems.

When present, grasses become quite significant in the prairie dog diet. They clip off and may partially consume seed heads and weeds. This clipping activity decreases the number of annuals, since they don't reproduce well when substantial photosynthetic material is lost. Thus, shorter, perennial grasses such

Places to see Prairie Dogs

- Ulm Pishkun State Monument—Interstate 15 south of Great Falls to Ulm (milepost 274), then west four miles on county road.
- Beartooth Wildlife Management Area—Interstate 15 to Wolf Creek, then northeast on U.S. 91 for three miles, then south five miles on county road.
- Greycliff Prairie Dog Town State Monument—Interstate 90 east of Big Timber, at milepost 390.
- Charles M. Russell National Wildlife Range—The range encompasses a large area with many possible sites to see prairie dogs. James Kipp Recreation Area—at milepost 242 on U.S. 191, north of Lewistown.

Once danger has passed, the prairie dog emits the "wee-oo" call to notify other members of the colony that everything is okay. photo: Harry Engels

as buffalograss and blue grama are favored by the actions of the dogs.

Prairie dogs expose the root crowns of both grasses and forbs in order to feed on the more succulent tissues. In preferred feeding areas, shallow digging frequently occurs. The dogs do this more frequently in late summer and fall when moisture content of stems is reduced.

About 75% of the plants used by prairie dogs also have some value as livestock forage. However, dogs often consume plant parts generally unused by livestock. Fallen seeds, roots, stolons and bulbs are regularly used by prairie dogs but not by livestock.

A PRAIRIE DOG TOWN offers a crossroads for wildlife activity in much the same way as a beaver pond does. Like other members of the ground squirrel group, prairie dogs are considered desirable fare by many predators. Coyote trappers know a prairie dog town is a good place to try their luck. Seldom, if ever, will a coyote pass by without making an inspection trip through the town. To successfully capture a prairie dog, coyotes, of course, need some cover. This is the main reason black-tailed prairie dogs do not tolerate tall vegetation. The relationship is simple: no cover, no coyote problems. If a dog builds its burrow a bit too close to tall vegetation, it may be in trouble. From the dog's viewpoint, two solutions to this problem are possible: Either cut down the tall vegetation or stay out of it.

The prairie dog can partially solve coyote problems, but other predators pose different difficulties. Most dog towns contain badger diggings. Many prairie dog burrows have more than one entrance, allowing the dogs to escape from the fast-digging badger. But some burrows have only one entrance. Should a badger select a one-hole burrow as

its target, the dogs are in big trouble. There is no escape, and chow time for the badger is assured.

The endangered black-footed ferret is, of course, the most publicized prairie dog predator. Ferrets live in dog towns and use the dog burrows as their own. The ferret's diet runs heavily to pure prairie dog, and the dogs are nearly powerless to defend themselves against this weasel-like mammal. When a family of ferrets moves into a prairie dog town, dogs attempt to bury them by plugging the burrows they choose. A concentration of plugged burrows in a dog town is evidence of ferrets. The dirt plugs, however, don't hamper a ferret very much. The ferret is an expert digger and can easily exit such an earthen prison. Because ferrets are extremely rare, impact on prairie dogs is negligible.

Other predators such as bobcats, red fox and weasels occasionally visit dog towns. Seldom do they enjoy a prairie dog entrée, however.

AVIAN PREDATORS pose yet another danger to prairie dogs. The eyes of prairie dogs are set quite high on their heads, positioned to provide quick detection of danger from above. But it doesn't always work. Golden eagles have taken substantial numbers of prairie dogs when an eagle nest is near a dog town. In 1908, E.S. Cameron described how golden eagles hunt prairie dogs ("Observations on the Golden Eagle in Montana," *Auk*, Vol. 25, No. 3, pages 251-267). He noted an eagle will soar above a town, inspect it and watch the actions of the dogs. Meanwhile, the alarm call goes out and the prairie dogs scurry for their burrows.

An unsuccessful eagle may continue soaring for several hours at a rather high altitude, until the prairie dogs relax and become convinced the eagle is not really hunting them. In Cameron's words: "When the eagle considers that a favorable chance has arrived it sinks lower, so as to bring the distance between itself and the animals to something like seventy-five or a hundred yards. Should the latter [prairie dogs] still remain above ground, the royal bird suddenly folds its wings, and, with meteoric rush, falls head first towards the astounded prairie dogs. These scamper for their holes, but about three yards from the ground the eagle spreads its wings and, swiftly following the intended victim, darts out a cruel foot to grasp it. If the attack fails, as sometimes happens, the eagle mounts in a slow, reluctant manner which plainly reveals its disappointment." If the eagle cuts the dog off from a burrow, the fate of the dog is sealed.

The ferruginous hawk approaches the problem of securing a prairie dog meal somewhat differently. It usually hunts prairie dogs from the ground, rather than from the air. By using a sagebrush plant or a screen of grass for cover, the ferruginous hawk simply waits out its intended prey. When a dog emerges from its burrow, the hawk sits quietly until the dog is some distance from the burrow. Then, the hawk suddenly darts out to capture the dog. The only difference between the coyote and the ferruginous hawk in use of this technique is that the coyote darts forward on foot, while the hawk does so on wing.

Many forms of wildlife other than predators exist around dog towns. Perhaps the best known associate is the burrowing owl. Burrowing owls don't dig burrows, but rather take over a burrow excavated by another animal. Considering the number of burrows in a prairie dog town, it's easy to see why burrowing owls homestead in a dog town. It's often assumed burrowing owls select an abandoned burrow for nesting but this is not always true. When a burrowing owl wants a dog burrow, it forcibly evicts the resident prairie dog. Each time the dog tries to get its burrow back, the owl teaches it a lesson. Once a pair of owls have set up housekeeping in a dog town, the dogs and owls get along pretty well. Owls sometimes land on a mound with a prairie dog only a few feet (or even inches) away, with the dog paying no attention to the owl. Burrowing owls do not eat prairie dogs, so they have little impact on the welfare of the dogs—outside of some inconvenience. (Burrowing owls feed mostly on grasshoppers, beetles and small birds and mammals.)

Other inhabitants of prairie dog towns include mountain plovers, rattlesnakes, toads, salamanders and a variety of prairie birds. The mountain plover nests only in areas where grass is short, so prairie dog towns provide ideal sites. Rattlesnakes, toads and salamanders all use burrows for shelter. Both toads and salamanders have been found deep within dog burrows where they probably retreat seeking moisture.

An alert observer can see other forms of wildlife around a dog town. Swainson's hawks are frequently sighted and occasionally may prey on dogs. Turkey vultures systematically hunt white-tailed prairie dog towns on occasion, but they do not appear to be a regular predator of prairie dogs. Marsh hawks are often seen on prairie dog towns, but are not known to prey on the dogs. Possibly, marsh hawks find easy hunting for small mammals in the short grass areas offered by dog towns. Desert cottontails frequently use the burrows of white-tailed prairie dogs for shelter or hiding. In fact, cottontails may be quite common on some dog towns and run from burrow to burrow when seeking protective shelter.

When looking at the ecology of any particular species, it becomes quickly apparent that no species stands by itself in any ecosystem. The presence of any one species is tied to the occurrence and welfare of many other forms of wildlife. When one species is removed from a system, the lives of dozens of other species are affected in some way, even though the effect may be small. Some relationships are very subtle and poorly defined, while others are dramatic. While we do not yet understand the full range of ecological influences which prairie dogs exert, their influence on Great Plains wildlife communities is substantial. ■

Weed Control

A Two-Part Overview of Weed Control Problems

A Weed Is A Weed Is A Weed... Or Is It?

MONTANA OUTDOORS: What is a "weed?"

JOHN WEIGAND: Many definitions have been proposed, but the most widely accepted one is "any plant which occurs where *man* does not want it." The main difficulty with this definition is that most people belong to special interest groups and see any given plant from different viewpoints. For example, the presence of musk thistle is undesirable to the farmer—it competes with grain for soil nutrients, space, sunlight and moisture. On the other hand, musk thistle provides valuable protective cover for pheasants and Hungarian partridge, food for partridge and both food and cover for many nongame animals. On range land, the rancher might like to replace hawthorn shrubs with grass for his cattle. But hawthorn provides food and cover for white-tailed deer and sharp-tailed grouse, as well as other game and nongame species. Pollen of certain plants causes allergic reactions in some persons, yet these same plants may have food and fiber values to agriculturalists and provide food or cover for wildlife.

MO: Is there a legal definition of a "weed?"

WEIGAND: SB 315, the Montana Noxious Plant Management Act, was killed by the 1977 Montana Legislature. The bill would have defined a weed as "any living plant which by its presence reduces land use for man's benefits." Since wildlife benefits man aesthetically, socially and financially and wildlife uses many kinds of plants, under this definition there would have been very few "weeds" in Montana. A major problem with most existing and proposed definitions is that they are based on economics. As such, one could define a weed as "any plant which does not have a dollar value." In other words, if it produces no income to the land user, it has no value. Since dollar values are difficult to assign to most wild animals, wildlife is the inevitable loser in monetary comparisons.

MO: Are "noxious" weeds defined differently?

WEIGAND: "Noxious weeds specifically named in the Montana Weed Law of 1969 include Canada thistle, wild morning glory (bindweed), whitetop, leafy spurge and Russian knapweed. The legal definition goes on to say, "and such other weed or weeds as may be defined and designated as a noxious weed by the board of county commissioners of each county, subject to approval by the county extension agent or agricultural experiment station at Montana State University...." *In other words, any plant in any county could be legally defined as "noxious."*

MO: But is it realistic to expect that *any plant* could be declared "noxious?"

WEIGAND: The following is offered for your judgment. Although the 1969 law defined only five species as "noxious," counties designated up to 28 *additional species* as "noxious." The accompanying table lists 19 of the 33 species which have been designated "noxious." A preliminary review suggests most are used by wildlife as food and some are used as cover. This table in no way implies the remaining 14 species have no value to wildlife. However, it suggests that little wildlife expertise was requested or exercised prior to plant condemnation by state and county agencies.

MO: Where does the Dept. of Fish and Game stand on weed legislation?

WEIGAND: The department is apprehensive about *any* legislative proposal which gives governmental agencies such broad environmental powers. If Montanans want wildlife perpetuated, the legislature should mandate Dept. of Fish and Game participation and authority in any agricultural-wildlife related proposals. Legislation which merely grants the option of seeking advice from wildlife professionals is inadequate and in no way guarantees the needs of wildlife will be protected.

MO: What happens to those weeds defined or designated "noxious?"

WEIGAND: The 1969 law makes it unlawful for *anyone* to wilfully permit these plants to go to seed on any owned, occupied or controlled land. This includes all private, federal (national forests, parks and range land) and state land, including land administered by the Dept. of Fish and Game.

continued

MO: Does the Dept. of Fish and Game then practice noxious weed control on these lands?

WEIGAND: Yes, within wildlife management priorities established for a given area and within our budgetary limitations. Many of these areas were purchased with money from sale of hunting and fishing licenses and are managed primarily for wildlife and recreation. To fulfill this trust, the habitat needs of wildlife must be considered and natural scenic or recreational values must be retained. At the same time, we try to be good neighbors to adjacent landowners by reducing noxious weeds, especially near farm lands. The distribution of Canada thistle on two such areas has been reduced noticeably, without widespread use of chemicals. Removal of cattle from one area and sheep from another appears to be primarily responsible for these reductions. The reduction in grazing pressure permitted more desirable plants to outcompete the less desirable plants. Changes in management practices here produced two noticeable benefits.

MO: Where do weeds come from?

WEIGAND: This must be answered two ways. First, these and other plants develop from seeds or other plant parts capable of generating the plant. Some plants grow from bulbs, tubers, parts of roots, rhizomes or stems (e.g., suckers and slips).

Second, plants may be native to Montana or they may have been introduced by various sources. Native plants became established over thousands of years, having been provided with proper soil characteristics, moisture, sunlight, elevation and other conditions. They are an integral part of Montana and native wildlife has evolved as part of the plant communities. These native plants and the wildlife dependent on them belong here. Native plant seeds, deposited in the soil over many years, are countless. While their range may be temporarily reduced through land uses and management practices, only the most severe and persistent land uses would eliminate them.

Introduced plants are generally those not native to North America. Many of the plants most troublesome to agricultural economics have been imported by agriculture via contaminated seed grains and hay. Increased mechanized vehicle travel has brought in some. Migratory wild animals probably brought in some more, or aided in the distribution of those already present. Introduced plants become successfully established in favorable environs, partly because of the absence of their native competitors. Overgrazed livestock ranges and disturbed soil sites (like roadways, crop fields, irrigation ditches) are prime areas for establishment. Proper range management and maintenance of native or desirable plants on disturbed sites (except crop lands) may be the most successful weed control measure.

MO: Is there any way to prevent noxious plants, present or potential, from entering Montana?

WEIGAND: Current Montana law (R.C.M. 1947, Sec. 3-802.4) is not stringent enough in this matter. It permits up to 2% noxious weed seeds per pound of agricultural seed for 11 plant species. These include leafy spurge, wild morning glory and Russian knapweed, which are among the five weeds currently defined as "noxious" in Montana. There are 10 other species, termed "restricted noxious weeds," which are permitted to the extent of from 9 to 90 seeds per pound of imported agricultural seed. If Montana's agricultural industry wishes to cease importation of these seeds and the possible establishment of these plants, this is one area of law needing revision.

MO: Is all weed control bad?

WEIGAND: No. Individual agriculturalists must exercise some management of undesirable plants to maintain profitable operations. They should have the freedom to select those management procedures and materials necessary to get the job done, provided those selections are reasonably containable and present no public hazards.

However, if the question were worded, "Is control of all weeds bad?" (with weeds defined only from an agriculturalist view), the answer would be "Yes." The issue of weed cotnrol would then enter the social arena because: (1) concern for a given plant species extends beyond individual property boundaries, (2) other public natural resources may be adversely affected by suggested management plans and (3) the power to tax the general public and expenditure of public funds is involved.

Agriculturalists, through previous legislation, have indicated they want public assistance in solving weed problems. The voting public, through elected representatives, will determine the form and extent of this assistance.

MO: Is biological control of weeds more desirable than other methods of plant control in protecting wildlife habitat?

WEIGAND: Biological control using insects is currently limited to introduced plants and seems to be quite effective in its objectives. Insect control agents appear to be host specific—they attack only one kind of plant or its close relatives.

Effective biological control of agriculturally noxious plants may seriously affect wildlife which uses the plants for food and/or cover. Insect agents do not recognize property boundaries and go almost anywhere their specific requirements are met. They attack plants in agriculturally idle areas. These same areas frequently contain the best (or the only) protective cover remaining for wildlife on intensively farmed or grazed areas. Most of these plants are forbs which provide more protective cover per plant than do grass-like plants. If they are the major protective plants and are removed by any means prior to or during seasons of wildlife use, habitat

Noxious Plants With Wildlife Values

(designated by counties since 1969)

COMMON NAME	SCIENTIFIC NAME	NO. OF COUNTIES	WILDLIFE USE FOR FOOD
blue lettuce	*Lactuca pulchella*	4	A, E, MD, WT, HP, P, white-tailed prairie dog, goldfinch
burdock	*Arctium lappa*	8	P
Canada thistle	*Cirsium arvense*	56*	A, E, M, MD, WT, BHS, hummingbirds, clay-colored sparrow
cocklebur	*Xanthium strumarium*	1	E, purple finch
cypress spurge	*Euphorbia cyparissias* (*Euphorbia* species)	1	(A, BHS, HP, mourning dove, horned lark, chipping sparrow, kangaroo rat)
wild morning glory (bindweed)	*Convolvulus arvensis* (*Convolvulus* species)	56*	WT (A, P, meadow mouse, pocket gopher, prairie dog)
ground cherry	*Physalis* species	2	P, ST, white-footed mouse, striped skunk
leafy spurge	*Euphorbia esula*	56*	See cypress spurge.
milkweed	*Asclepias* species	2	A, P
musk thistle	*Carduus nutans*	3	HP
prickly lettuce	*Lactuca serriola*	2	A, E, WT, P, SG, goldfinch, white-tailed prairie dog
puncture vine	*Tribulus terrestris*	2	kangaroo rat
quackgrass	*Agropyron repens* (*Agropyron* species including *repens*)	1	(A, E, BHS, M, MD, WT, P, ST, snow bunting, jackrabbit, cottontail, black-tailed and white-tailed prairie dog, ground squirrels)
Russian knapweed	*Centaurea repens*	56*	E, WT
spotted knapweed	*Centaurea maculosa* (*Centaurea* species)	14	(mourning dove, goldfinch, pine siskin, song sparrow, spotted towhee)
sowthistle	*Sonchus arvensis* (*Sonchus* species)	7	A, HP, P, goldfinch (BG, SG, ST)
whitetop	*Cardaria draba*	56*	SG
wild licorice	*Glycyrrhiza lepidota*	5	E, MD
wild oats	*Avena fatua* (*Avena* species)	1	HP, P (WT, MD, MA, CG, CP, ST, T, mourning dove, sandhill crane, 32 species of nongame birds, 8 species of small mammals)

A=antelope, BG=blue grouse, BHS=bighorn sheep, CG=Canada goose, CP=chukar partridge, E=elk, HP=Hungarian partridge, M=moose, MA=mallard, MD=mule deer, P=pheasant, SG=sage grouse, ST=sharp-tailed grouse, T=turkey, WT=white-tailed deer

*defined by law as noxious statewide

values are reduced. If their removal results in increased grass production and livestock is permitted to intensively graze the area, wildlife habitat may be eliminated. Reduction of habitat quality and quantity then results in a reduction of associated wildlife.

MO: Will biological control require a change in control philosophy?

WEIGAND: The history and philosophy of any control program in Montana has been the repeated treatment of "symptoms." Program success in one area results in its application elsewhere and it becomes a panacea—a "cure-all"—for reducing numbers of undesirable plants. Many of us now recognize the fallacy of the panacea approach for using herbicides. Control successes mask the "disease" and may permit it to be economically bearable or even profitable on a short-term basis.

MO: To what extent does Montana's wildlife depend on plants?

WEIGAND: Almost totally. Herbivores eat little but vegetation, carnivores depend on herbivores as sources of food and there are some animals which eat both plants and animals. Plants are an inseparable base for all Montana wildlife, just as they are for livestock and crop management.

MO: How many kinds of plants does wildlife eat?

WEIGAND: Although no master list is available, various reports show extensive use. For example, antelope in the northern Great Plains have been found to consume 38 different kinds of shrubs and trees, 203 forbs (broadleafed plants) and 23 grasses and sedges. For elk in the Rocky Mountains, the list contains 95 shrubs, 159 forbs and 59 grasses. Research has shown mule deer in this region eat 165 kinds of shrubs and trees, 273 forbs, 72 grasses and sedges plus 15 other kinds of plants. Preliminary examination of over 2,600 food habits records for Montana upland game birds showed parts of 14 kinds of trees, 28 shrubs, 125 forbs, 31 grasses and 9 other plants. The total number of plants eaten by wildlife in Montana is even longer when other kinds of wildlife, including nongame species, are included. Also, *different* plants are often used for cover.

MO: Surely no game bird eats all of these different plants?

WEIGAND: True. In fact, some have quite specialized diets. Sage grouse have evolved a unique digestive system which limits them to sagebrush and a few other plants growing in sagebrush areas, including goat's-beard or salsify, dandelion, prickly lettuce, blue lettuce, prairie pepperweed, curlcup gumweed, littlepod falseflax, yarrow and vetches.

Hungarian partridge seasonal diets are somewhat broader. Although 59%-78% of their diet is cultivated grains, partridge also feed on at least 17 kinds of forbs. One forb, smartweed, reached a maximum of only 3% of seasonal diets, yet it was eaten every season and by adults as well as by chicks. Smartweed is known to be richer than barley in calcium, magnesium and nitrogen and it may provide a necessary balance of nutrients in the overall diet. We recognize the desirability of well-balanced diets for people and should not be surprised that wildlife has similar needs.

MO: Any of these plants that provide food and/or cover for wildlife can be declared "noxious" in Montana?

WEIGAND: According to the Montana Weed Law of 1969 and provisions of proposed 1979 legislation, that is correct. You can readily see why wildlife input into this legislation is vital for Montana's wildlife.

MO: You have said that introduced plants are the most troublesome in farming and ranching and that they were not originally necessary for the well-being of wildlife. Why shouldn't they be controlled now?

WEIGAND: Some reasons were given previously. In addition, wild animals have the ability to select those plants, and even certain parts of plants, which are richest in nutrients. That introduced plants are eaten by wildlife indicates they probably are nutritionally superior to native plants—at least at that particular time.

MO: Are you then suggesting we should encourage range expansion or the introduction of exotic plants which benefit wildlife, say for example on reclamation projects?

WEIGAND: Not necessarily. Introduced plants represent problems to agriculturalists and primarily to farmers; i.e., they are searching for some economic relief from these plants. It would be naive to assume a farmer will not attempt to control these plants in his crops. However, we cannot and do not endorse a "phytophobiac" attitude (a person who fears plants or certain kinds of plants) toward these same plants on noncrop lands. Similarly, undesirable introduced plants on one range land does not automatically condemn them on all other lands or even on other range land.

The term "reclamation" indicates the return to a predisturbance condition. Unless this condition was crop land, it was dominated by native plants. Native vegetation should be considered first for seeding of disturbed sites because of its natural adaptation to soil, physiographic and climatic conditions. First seedlings may not re-establish on such sites due to severe alteration of soil structure and texture. In these cases, establishment of earlier successional native plants should be attempted. Exotic plants, with their attendant potential to become noxious, should be considered only after a reasonable spectrum of native establishments has been tried and evaluated.

MO: What seems to be the biggest obstacle in correcting Montana's weed laws to consider wildlife?

WEIGAND: Communication

and understanding among the groups concerned with these problems. There is a great deal of general, nontechnical information available on food and cover requirements of Montana's wildlife. But the technical, scientific data are not generally available to the public, except through wildlife biologists, technical papers and journals and university libraries. Attempts to publicize wildlife information began with formation of the Montana Dept. of Fish and Game in 1901. These efforts have accelerated since the mid-1940s and this magazine certainly represents part of that effort. But the findings are easy to ignore when wildlife is plentiful. People only become concerned when the wildlife supply is dwindling or scarce. The time to apply this information should coincide with wildlife abundance, to keep it abundant. When application is delayed until most of a population is lost, management procedures are aimed at preventing wildlife's extirpation. Even if the population is saved, it may be a long, hard battle to restore it to an abundant status. At present, the needs for wildlife are simply not being properly considered.

MO: Has this communications gap been bridged?

WEIGAND: Only in part. Two pieces of legislation were drafted by the Montana Noxious Plant Management Advisory Council appointed by the governor in 1976. The department was represented on this council to provide wildlife input. All provisions with obvious or potential adverse impacts on wildlife were nonetheless retained in the proposals (SB 315 and HB 122) introduced into the 1977 legislature. Fortunately, neither measure passed.

MO: Isn't HB 122 currently under review for reintroduction into the 1979 Montana Legislature?

WEIGAND: Yes. A joint House-Senate committee will be conducting hearings on this bill during 1977-78. Again, the department is providing input to protect wildlife's interest in Chapter 3 of HB 122, the section on agricultural pests. The department is extending full cooperation to this committee and Montana's public in providing any assistance necessary to help understand these issues. Hopefully, the advice we give will be accepted and adopted as part of the final draft of this bill.

The Biological Control Of Weeds

Man's struggle with weeds has a long history, probably originating with invention of the hoe. Yet even today, despite sophisticated methods of weed control, weeds are still abundant. In fact, the number of acres infested with noxious weeds is presently increasing at an alarming rate.

Why is the number of weed-infested acres increasing? The answers are numerous, but three important reasons include: (1) most weeds occur in areas inaccessible to spray equipment, (2) those infestations which are accessible are often so large that chemical control is economically impractical and (3) many weeds are simply not succumbing to herbicides. Also, the public has become increasingly displeased with chemical herbicides because of their potentially harmful environmental effects. These problems automatically lend themselves to biological control of weeds as a possible solution.

Biological weed control is the deliberate use of natural enemies to reduce weed densities to more tolerable levels. Included among natural enemies of weeds are viruses, bacteria, fungi, parasitic plants, nematodes, mites and insects. Of these, insects have been most widely used against weeds because of their great variety, high degree of host specialization and specific adaptations to their host.

Use of biological control is by no means a new and untested technique. In fact, insects have been used for biological control of weeds for more than a century. In 1863, an insect was introduced into India for cactus control. Since then, more than 30 weed species have been biologically controlled in various parts of the world.

Two classic cases of successful biological weed control were the control of pricklypear cactus in Australia by a moth imported from Argentina and control of St. John's wort (also called goatweed or Klamath weed) in California by a beetle brought from Europe. The Australian pricklypear infested some 60 million acres. It was almost completely eliminated by the moth, allowing most of what was previously "useless" land to be returned to productive farm land and pasture. Likewise, the 2 million acre infestation of St. John's wort in California was reduced by more than 99%. Although biological control of pricklypear and St. John's wort occurred in 1925 and 1946, respectively, both weeds remain under control today.

The permanence of biological control as shown by the above cases is a distinct advantage over other methods of weed control. This occurs because biological agents perpetuate themselves, thus insuring their continued presence and pressure on the target weed. Biological control has additional advantages: It is environmentally safe since no

chemical residues or other toxic substances are introduced into the environment; it is comparatively economical, and it is very selective. Also, biological control does not require fossil fuel since the energy utilized by the biological control agent is obtained from the weed itself.

Certainly, biological weed control has its limitations. Weeds least amenable to biological control include: (1) those that must be controlled immediately. Biological control is a long-term process generally requiring from three to five years before significant damage to weeds is evident. (2) weeds that require complete elimination. The aim of biological control is not eradication but reduction of weeds to more tolerable levels. (3) weeds valued under certain circumstances. Conflicts of interest often arise about whether a particular plant should be classed as a weed. The problem originates with the definition of a weed which states, "A weed is a plant in the wrong place." For example, a plant prized by gardeners may be a serious pest in a farmer's field. In addition, some weeds provide valuable food and shelter for wildlife. Therefore, biological control is considered only when the noxious qualities of a weed greatly outweigh its beneficial aspects. (4) weeds closely related to beneficial plants. Biological control agents will be unable to discriminate between closely related plants. (5) weeds on crop land under intensive cropping practices. Since presence of the host weed is essential to survival of the biological control agent, any practice which drastically reduces the weed population will prohibit establishment of the agent.

Biological control is most effective against an introduced weed occupying large acreages of range land, waste or wilderness. An introduced weed is a preferred target simply because the natural enemies that kept the plant in check in its native area were left behind when it was introduced into a foreign area. While this lack of natural enemies accounts for the reason most introduced weeds are increasing so rapidly, it also makes them especially vulnerable to introduction of one or more of their original natural enemies. The size of these infestations makes them unsuitable for chemical control because of the tremendous cost.

The potential use of biological agents against native weeds should not be overlooked. Control attempts would involve augmentation and conservation of natural enemies already present.

The fear that introduced natural enemies will leave their weed host and attack a beneficial plant has been the main factor preventing widespread acceptance of biological weed control. These fears have diminished because of past results and the extensive research and screening procedures conducted on potential agents before release. To date, no insect released for weed control has become a pest.

Once the insects are declared safe for release by the U.S. Dept. of Agriculture (USDA), they are sent to cooperators in those areas of the country with the target weeds. These cooperators assume the next step—monitoring the released insects in the field. Ideally, these monitoring efforts include studies to determine the success or causes for lack of success of the released insects. Later, studies on established insects evaluate effects on target weeds.

The importance of adequate follow-up studies on introduced insects cannot be overemphasized. A number of weed-feeding insects have been introduced into Montana. Some either failed to survive or became established but did not control the target weed. Reasons for these failures are not known, due largely to lack of adequate follow-up study.

The first full-time biological weed control study in Montana began in 1974 and involved a small fly released on spotted knapweed. For two summers, study included daily observations and measurements on both the fly and the weed. Information from this study prompted the Montana Agricultural Experiment Station to set up a full-time program of biological weed control in 1976, with cooperation from the USDA and various counties in western Montana.

As mentioned earlier, other insect releases in Montana have met with varying degrees of success. The first release occurred in 1948 with introduction of the same beetle which controlled St. John's wort in California. Control was achieved at a few sites, but most release sites were unaffected.

A moth introduced for control of Dalmation toadflax, a seed weevil released on puncture vine and a flea beetle released on Canada thistle all failed to survive in Montana. A moth released on leafy spurge has survived, but only in small numbers.

On the other hand, a seed weevil released during 1969-73 on musk thistle in Gallatin County is increasing rapidly and has spread over 500 square miles of the Gallatin Valley. This weevil will significantly reduce musk thistle populations in the next few years. The previously mentioned fly released for control of spotted knapweed during 1973-75 also appears promising. The fly is established and increasing at various sites in western Montana. It produces a cancer-like gall in the seed heads of the plant which reduces seed production. A new insect, a moth that attacks leafy spurge, was released in summer 1977. Follow-up studies on the insect began in 1978.

Biological weed control will not provide the total answer to the weed problem. Biological control, like other methods, only treats symptoms, not causes of the weed problem. Nevertheless, biological control offers great potential as a useful tool in the long-term management of weeds.

As with other weed programs, biological control strives for *reasonable* reductions of target plants, not elimination of *all* weeds. Hopefully, by combining biological and other control methods with improved management practices, populations of many problem weeds will be reduced.—*Jim Story* ■

The Catchall

Anaconda Co. Muddies Warm Springs Creek

For over 40 years, Montana hasn't been able to do enough to protect one of its prime trout waters from an onslaught of silt. Almost every year, the Anaconda Co. has flushed silt into Warm Springs Creek when it cleans its cement-bottomed Meyers Dam, which supplies water to company operations in Anaconda.

But last year was different.

When the company flushed most of a two-year accumulation of silt into the creek Aug. 16, a fish and game field biologist was on the scene to monitor the process. And what he saw alarmed him. Biologist Jim Vashro collected water samples as the creek became black with mud. By late afternoon, the silt had muddied the water more than six miles from the dam at the Washoe Trout Hatchery in Anaconda. Vashro notified Jim Rasmussen, coordinator of water pollution enforcement for the Water Quality Bureau of the Dept. of Health and Environmental Sciences (DHES).

The polluted water (above) entering Warm Springs Creek. Anaconda Co. cleaning sediment from Meyers Dam. Most of the sediment went down the creek. F&G photos: Jim Vashro

Vashro said he had informed Anaconda's biologist that a permit to temporarily violate the state water quality standards is required by state water pollution laws. This permit would be issued only after all reasonable measures are taken to prevent such short-term contamination. Application to the DHES for this type of permit is necessary before initiating any activity that may cause a violation, Rasmussen said.

To Vashro's surprise, the company continued cleaning the dam the next day, despite his warnings. The biologist was attempting to continue testing that day but had to stop because the water "was so turbid, I couldn't even go in [to conduct the tests]."

Anaconda Co. spokesman Alec Hansen acknowledged the company had continued flushing silt into the creek, but added the project was "stopped before completion." The company had been cleaning the dam in the same way for more than 40 years, Hansen said. Dept. of Fish and Game officials were always notified before the process was begun, he added.

But in 1977, the cleaning of the dam was done in a way that "apparently wasn't acceptable" to state health officials, Hansen said. He noted the dam wasn't cleaned in 1976, but added that he didn't know why it hadn't been.

Anaconda's recent water improvement programs have allowed fish to return to the Clark Fork River, into which Warm Springs Creek flows. However, these improvements have been on the Clark Fork River proper and *not* on Warm Springs Creek.

Water samples analyzed in health department labs indicated that water quality standards for turbidity (suspended sediment) had been exceeded by more than 150 times the allowable limit on the first day of the flushing. Montana's water quality standards give Warm Springs Creek a B-D1 classification that stipulates

recycled paper

"the maximum allowable increase above naturally occurring turbidity is 5.0 Jackson Turbidity Units" (JTU's).

Samples collected Aug. 16 at the discharge site measured 800 JTU's, Rasmussen reported. The in-stream concentration 100 yards from the dam was 650 JTU's, and at the hatchery the measure was 42 JTU's. The background concentration above the dam that day was 0.9 JTU.

Samples collected Aug. 17 also exceeded state water quality standards. No reading was taken of the discharge, because Vashro was not notified any flushing would occur. Water taken 100 yards from the dam showed 52 units of turbidity, and two miles from the dam, the reading was 50 JTU's, Rasmussen said.

Maximum fines for violation of Montana's water quality standards range from $10,000 a day for civil actions to $25,000 a day for criminal actions, which are defined as "willful or negligent pollution of state waters." (No criminal suits have ever been filed in Montana, probably because of the difficulty in proving the charge, according to Don Willems, chief of the Water Quality Bureau.)

In late August, Rasmussen turned over the test results to the DHES legal staff for possible action.

Vashro reported that most trout survived the flood of silt, but large numbers of sculpin, on which trout feed, were killed. Vashro also noted that silt hampers spawning because it covers eggs and smothers aquatic insects on which the fish feed. The abrasive action of the silt also increases the incidence of disease to the trout and insect populations. Bill Matthew, manager of the Washoe Trout Hatchery, reported no losses were suffered at the hatchery.

Fish and game officials have been concerned about the pollution of Warm Springs Creek for years. In 1968, they met with the Anaconda Co. to discuss methods of cleaning the dam and suggested pumping the silt from the dam to "a cottonwood area immediately downstream" from the dam, according to a September 1968 fish and game memorandum. The company did agree at that time to delay the cleaning of Meyers Dam until after Aug. 15, when only one crop of fish would be in the hatchery, Hansen said. The company honored this limited agreement and the hatchery had "no problems" with the silt, according to Bob Mitchell, who managed the hatchery until last year. But since the 1968 meeting, the flushing practice remained essentially unchanged, according to Ralph Boland, assistant administrator of fish and game's Ecological Services Division.

The Water Quality Bureau had "no reason to be involved" with the cleaning of Meyers Dam until 1975, Willems said. He explained that until July 1, 1975, the wording of state water pollution laws was such that operation of dams was considered to be "natural," not subject to water quality standards. However, the words "reasonable operation" of dams were added to the law in 1975, apparently recognizing that certain processes involved in cleaning dams may in fact be "unreasonable" and subject to the law.

The company did not secure a permit to pollute in 1975 before cleaning the dam, Rasmussen said. But fish and game did not have a biologist stationed in the area at the time and the process was not monitored that year. Another reason the problem was overlooked in 1975 might have been because the Water Quality Bureau did not have a full-time enforcement coordinator until Rasmussen was hired in late 1976.

In August 1977, Hansen reported the company planned to submit a proposal which would insure the problem "would never happen again." In October, Rasmussen recommended that the health department's legal division take the Anaconda Co. to court over the matter. But one of the department's attorneys, Stan Bradshaw, instead sought an out-of-court settlement with the company. Health and fish and game department officials met with Anaconda officials at Meyers Dam in early December to discuss details of Anaconda's plan to alter future cleaning processes.

Negotiations were completed in late January 1978. Anaconda paid a $3,500 fine in the out-of-court settlement and must file a compliance plan for future cleaning of Meyers Dam.—*Barbara Miller*

Montanans Head Professional Groups

Art Whitney

Les Pengelly

It's quite an honor for one Montanan to head a national professional organization. But this year, two Montanans have been elected president of prestigious groups. Former Fish and Game Commissioner Dr. W. Leslie Pengelly has been elected president of The Wildlife Society and Arthur N. Whitney, administrator of the Dept. of Fish and Game Fisheries Division, has been installed president of the American Fisheries Society.

Pengelly, director of the wildlife biology program and professor of wildlife management at the University of Montana, Missoula, served as vice president of The Wildlife Society in 1976-77 and will assume his official duties as president of the organization this month.

Founded in 1937, The Wildlife Society is a professional, nonprofit organization dedicated to wise management and conservation of the world's wildlife resources. Its members—over 10,000—include administrators, educators, information and law enforcement specialists, managers and research scientists in over 70 countries.

The society's principal objectives are: "to develop and promote sound stewardship of wildlife and of the environments upon which wildlife and man depend, to undertake an active role in preventing man-induced en-

vironmental degradation, to increase awareness and appreciation of wild values and to seek the highest standards in all activities of the wildlife profession."

The society's purposes are served through chapter, sectional, national and international meetings and by its publications, *Journal of Wildlife Management*, "Wildlife Monographs," "Wildlife Society Bulletin" and a society newsletter and books on scientific and professional subjects.

Pengelly, a 30-year member of the society, joined the UM faculty in 1954 and directed the university's Wildlife Extension Unit for nine years. In 1963 he was appointed professor of wildlife management in the School of Forestry. He earned a B.A. in biology from Northern Michigan University, Marquette; his M.S. from the University of Michigan, Ann Arbor, and the Ph.D. from Utah State University, Logan, both in wildlife conservation.

A past president of the Western Division of the American Fisheries Society (1971-72), Whitney joined the department in 1951 as a fisheries biologist in Miles City. He left for a year and worked as an aquatic biologist for the Minnesota Dept. of Conservation. In 1954, he rejoined the department as a fisheries manager for the Missoula region. He became administrator of the Fisheries Division in 1963.

He earned his B.S. in fish and wildlife management in 1949 from the University of Minnesota, St. Paul, where he also did graduate work.

The 108-year-old American Fisheries Society represents both professional and nonprofessional workers in fisheries science and practice. With over 7,000 members, the society has worked to advance all aspects of fisheries research and management. Through its publications and meetings of its committees, divisions, chapters and disciplinary sections, the society is a guiding force in the conservation, development and wise utilization of all aquatic resources. Its activities cover a broad front, including aquatic biology, economics, engineering, fish culture, limnology, marine ecology, oceanography and fisheries technology.

The society considers the following areas of critical importance: new studies in fish health and control of fish diseases, preservation of endangered aquatic species, studies on introduction of harmful exotic species, protection of fisheries habitat and the problems of chemicals and their effects on fish.—*Steve Byers*

Incorrect Acreage

In "Wilderness and Wildlife" in the Jan./Feb. 1978 issue, it was incorrectly reported that the Spotted Bear River Habitat Management Unit comprised 1,034,000 acres. The management unit actually contains about 142,800 acres.

The Little Things Count Up

A well-tuned car averages 6% more miles per gallon than an untuned automobile.

*****

Every time an oven is opened, the temperature drops 25-30 degrees.

*****

Glass or ceramic dishes used in the oven require temperature settings about 25 degrees lower than metal pans.

*****

Most homes lose the greatest amount of heat though the roof which is, incidentally, also the easiest part of the house to insulate.

*****

A frost-free refrigerator uses 30% more energy than a manual model.

*****

Energy used by 200 million Americans for air conditioning in one year equals the total annual energy consumption of 800 million Chinese.

*****

Taking a shower uses less hot water and thus less energy than taking a bath.—*courtesy the Montana Energy Advisory Council*

Peregrine Falcon Sightings

Eighty peregrine falcons have been released into the wild in Alberta and Saskatchewan during the past two years. Many of these birds may migrate through Montana and some may even have wintered here.

All of these birds have been banded with a standard band on one leg and a black band with white numbers on the other leg. Should you see one of these birds, please notify Dennis Flath, Research Park Building, Box 5-Montana State University; Bozeman, MT 59717, in writing as promptly as possible. Information should include: (1) name of observer, (2) location by section, range or township and (3) band number, if possible.

National Wildlife Week

More than 12 million school children, teachers and conservationists are expected to participate in National Wildlife Week, March 19-25. "Wildlife Needs You" will be the theme for the 41st annual observance of the week first proclaimed as Wildlife Restoration Week by Pres. Franklin D. Roosevelt in 1938. The observance has been sponsored each March since by the 3.5-million-member National Wildlife Federation (NWF).

About 240,000 teachers in all 50 states, Guam, Puerto Rico and the Virgin Islands have received wildlife education kits. Among other things, the kits contain two posters—one picturing 16 wildlife species and the other a close-up color photograph of a peregrine falcon by Canadian wildlife photographer David Hancock. (See back cover.)

The peregrine falcon was chosen for the poster as a symbol of the need for public concern over wildlife, according to NWF Pres. Ray Arnett of Stockton, Calif. "The peregrine was once threatened with extinction by pesticides," said Arnett, "but when the public got concerned and did something about pesticides, the trend was reversed and the bird may now survive."

Never a populous species, by 1960 the peregrine had nearly disappeared from the eastern United States and was declining rapidly in the West. Some researchers blamed DDT for the bird's disappearance in the East. Because the peregrine is carnivorous, at the top of the food chain, it accumulated DDT by eating other animals which had ingested the pesticide. The DDT caused shells of the birds' eggs to become so thin they broke before hatching.

In the entire United States, only about 20 active nests existed in 1969-70. A slow turnabout began in 1972; Congress, responding to demands of conservationists, virtually outlawed use of DDT and similar pesticides in this country.

In 1973, 20 peregrines were hatched at Cornell University in New York. By fall 1977, about 133 young birds had been released in the wild, both east and west of the Rocky Mountains. Within the next seven years, the Laboratory of Ornithology at Cornell wants to establish some breeding pairs in the wild in the East and to increase the number of productive nests

in the West.

The other poster, picturing 16 different wildlife species ranging from the mountain goat to the gray treefrog, describes each of the animals in three languages—English, Spanish and French.

"There are many things we can do to foster a healthy and abundant wildlife population in this country," said Arnett. "National Wildlife Week will emphasize education, legislation and citizen concern. The preservation of wildlife habitat is one of the areas in which wildlife needs our help. In the past year, millions of dollars were spent by the federal government to preserve habitat, but billions were also spent to destroy it."

As an example of recent legislation benefiting wildlife, Arnett cited the 1977 law regulating strip mining. "This act, requiring restoration of land, will aid wildlife in some areas," he said. "And some of our threatened and endangered species are making comebacks thanks to other environmental protection laws. What we need," Arnett emphasized, "is a strong feeling for and full understanding of the ties between men, wildlife and the environment. When everyone understands their interdependence, then the outlook will be better for all three."—*National Wildlife Federation*

Contributors

A prairie dog town is a world of fascinating activity. Of five species occurring in North America, only black-tailed and white-tailed prairie dogs inhabit Montana. And, as **Dennis Flath** points out, habits of the two are as different as the color of their tails. Flath is the department's nongame species biologist. He holds a B.S. in biology from Pacific Lutheran University, Tacoma, Wash., and an M.S. in wildlife biology from the University of Montana, Missoula. Turn to "At Home with the Prairie Dog" on page 2.

"Weed Control" is a controversial, complex problem—especially when you consider that one person's weed might well be someone else's food. In "A Weed is a Weed is a Weed...or is It?" **John Weigand** points out that most people belong to special interest groups and see any given plant from different viewpoints. A weed that might pose a pesky problem for a rancher could provide food or cover for wildlife. Weigand is the fisheries and wildlife biologist supervisor for the Wildlife Division's Research Bureau in Bozeman. He holds a B.S. in biology from Wisconsin State University, Stevens Point; an M.S. in wildlife management from Michigan State University, East Lansing, and a Ph.D. in fish and wildlife management from Montana State University, Bozeman. He was the department's representative on the Montana Noxious Plant Management Advisory Council. In the second part of the overview, **Jim Story** examines "The Biological Control of Weeds." As he defines it, biological weed control is the "deliberate use of natural enemies to reduce weed densities to more tolerable levels." Story is an entomologist with the Montana Agricultural Experiment Station at MSU. He earned a B.S. in fish and wildlife management and an M.S. in entomology, both from MSU. The articles begin on page 9.

In spite of man's attempts to eradicate him, the coyote has almost nonchalantly expanded his range. The coyote is probably capable of generating more strong emotions than just about any other wild animal. As **Philip Schladweiler** writes "Clearly, there is considerable interest in the coyote." His article provides an update on the department's research into coyote/big game interactions. Schladweiler is a game research biologist with the department's Research Bureau in Bozeman. He holds B.S. and M.S. degrees in wildlife management, both from the University of Minnesota. Turn to "The Wily, Wild Dog" on page 28.

Since earliest recorded history and probably before, mankind's curiosity has been kindled by the unknown. Reports of man-like beasts roaming various corners of the earth date back many centuries. Among the most persistent of the sightings are reports of a "bigfoot," or "sasquatch." Although the creature goes by many names, sightings have occurred so persistently that the possibility of their being truth cannot be ignored. **Vern Craig's** section of "Is There a Bigfoot?" provides some background information on the man-like creatures. Craig is the chief of the department's Conservation Education Bureau. **Dr. Grover Krantz** answers the question, "Is There a Bigfoot?", by saying "Definitely." Krantz is an associate professor in the Anthropology Dept. at Washington State University, Pullman. He holds B.A. and M.A. degrees in anthropology, both from the University of California, Berkeley, and a Ph.D., also in anthropology, from the University of Minnesota. In "I Doubt It," **Dr. W. Leslie Pengelly** states his doubts about bigfoot's existence. Biographical information about Pengelly appears in "Montanans Head Professional Groups" in this issue's "The Catchall" section. The bigfoot articles begin on page 31.

A relatively new wildlife technique supplements the traditional wildlife research tools of binoculars and notebook. And as **Ken Walcheck** writes, "numerous studies throughout Montana and the world [are] using radio tracking to eavesdrop on age-old mysteries of animals." His article on telemetry, "Tracking the Wild Ones," begins on page 36. Walcheck also continues the series on nongame species with a fascinating look at the snowy owl. In "Ghostly Wanderer from the North," he looks at the owl's life history and explores the intricate relationship with the mouse-like lemming. The article begins on page 44. Walcheck is the department's information officer for the Miles City region. He received his B.S. in wildlife conservation and biology from Wisconsin State University and his M.S. in applied science (ecology) from MSU.

Montana Outdoors wants to thank the following three persons for their special contributions to this issue: **Barbara Miller** for her article, "Anaconda Co. Muddies Warm Springs Creek," which leads "The Catchall" section; **Larry Thompson** for his illustration for "Tracking the Wild Ones," and **Takehiro Taira** for his pen and ink illustration of the snowy owl for "Ghostly Wanderer from the North." Miller is the former editor of the Montana Kaimin, student newspaper at UM; Thompson is a biologist with the Energy Planning Division of the Dept. of Natural Resources and Conservation, and Taira operates the Leisure Art Studio in Kalispell, Mont.

Winter Scenes

The *haiku* is a tiny verse form in which Japanese poets have been working for hundreds of years. There are only 17 syllables in the *haiku* and the poem almost always contains the name of a season or a key word inferring the season. It is not intended to be a complete or even always a clear statement; it portrays a fleeting, transient image or impression. Although the *haiku* form is used today, the four included here are from famous Japanese poets of the past (probably writing in the 17th or 18th centuries). They convey—in simple, but eternal terms—that all things and creatures are part of the universal, interrelated brotherhood of creation. The four *haiku* are from "Cherry-Blossom" and "Haiku Harvest," reprinted with permission from The Peter Pauper Press; Mount Vernon, New York.

photo: Vince Claerhout

LAST NIGHT A SNOWFALL...
TODAY CLEAR COBALT
HEAVEN AND
WHITE-MANTLED PINES

Roka

photo: David Shors

photo: George Wuerthner

OH THE FIRST SNOWFALL!
WHO COULD STAY INDOORS
ON SUCH
A GLORIOUS DAY!

Kikaku

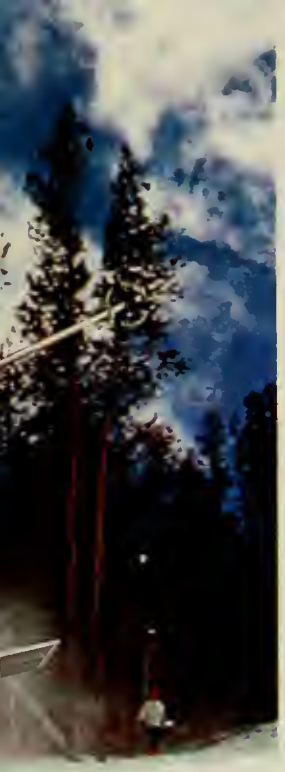


photo: Jerry Manley

photo: Vince Claerhout →

A MOUNTAIN HAMLET...
UNDER THE GREAT
WHITE SNOWDRIFT
A GURGLING BROOK

Shiki

photo: Jerry Manley

photo: Larry S. Thompson

photo: Harry Engels

photo: Paul H. Dix (Reflejo)

IT IS WARM TODAY...
BUT I THINK
I FEEL THE CHILL
OF THAT WINTER SUN

Onitsura

photo Danny On

Dear F&G

Don't Eradicate the Grizzly

I have just read the letter from Roger Stang of Superior, Mont. in the Nov./Dec. 1977 "Dear F&G" section. I can only say I am sorry he feels the way he does about the grizzly and hope there are not too many like him around.

He states that many animals have become extinct because their time had come and, in most cases, it was by natural occurrence. I would like to ask Mr. Stang about the demise of the passenger pigeon or the near-eradication of the buffalo. Were these natural causes? How about the black-footed ferret? Has he become so rare by natural causes or from man's everlasting destruction of prairie dogs, the ferret's number-one food? And how about the grizzly himself? Has he been put on the threatened species list because his time has come or because his numbers are dwindling because he cannot compete against man who continually takes away his environment?

I sincerely hope that we never lose the grizzly bear or we will lose a really beautiful animal that has even more right to be here than we do. Of course, we will always have conflicts between grizzly and man as long as we continually invade the bear's dwindling territory. If people do not wish to risk such an occurrence, then they should not venture into areas where there are grizzlies. To blame the grizzly for not getting along with man is a great injustice, for we have not yet learned to get along amongst ourselves. How can we expect the grizzly to tolerate us when we cannot even tolerate ourselves?

Mr. Stang also states that some grizzlies have begun to look upon man as a source of protein. I would be willing to bet that if Mr. Stang checked out the ratio of number of people viewing grizzlies to the number of grizzly-human encounters, he would find it very minuscule indeed. I would also bet that a majority of grizzly-human conflicts occurs when grizzlies are surprised while feeding or with cubs. And what human mother would not try to protect her young if she felt harm might come to them?

Granted, some grizzlies which attack humans may do so out of illness or meanness and would be better off destroyed. This number is probably small, too.

I have seen grizzlies in a zoo and that is no place for them to wind up. They, like other animals, are too beautiful to be locked up in a cage. I surely hope Mr. Stang will someday change his views of the grizzly and I hope that we will never see the eradication of this great animal.—*Wayne Yearout; Fort Benton, Mont.*

Wilderness Issue Overview

We enjoyed the Jan./Feb. 1978 *Montana Outdoors* and are especially pleased with your magazine's long overdue coverage of Montana's endangered wild lands. The wilderness areas discussed constitute but a fraction of Montana's threatened *de facto* wilderness and we hope both the magazine and the Dept. of Fish and Game will play an active role in protecting all these lands.

We feel it is important to inform the public about what we stand to lose if we don't take action to prevent destruction of our dwindling wilderness. The more exposure these areas receive, the better our chances are for preservation.

We are very happy to see your magazine start covering these issues and encourage you to continue.—*Ruth and Mike Gardner; Helena, Mont.*

A Newly Awakened Sentiment

Before transferring to St. Maries, Idaho, my boss was involved in the Flathead National Forest's wild and scenic river studies for the Flathead River system. In his historical research, he found the enclosed quotation, which he copied and saved. I thought it might be of interest to your readers.—*Bob Wagenknecht; St. Maries, Idaho*

"During the past few years, we have come to the realization that we have been a wasteful people in the past, not wantonly so, perhaps, because the natural resources of the country appeared to be practically limitless. More thoughtlessly than viciously we have denuded the mountains of their timber, squandered the treasure of the earth and of less economic value, but of as great sentimental interest, we have either deliberately slain the animals of the primeval woods or made impossible the conditions of their existence. The reckless extravagance of waste is having its inevitable reaction in growing conservatism among thoughtful, farseeing men and women. With newly awakened sentiment we look about us, feeling a sorrowful sense of loss never to be quite repaired, and seek to preserve that which is still left of nature's treasure within our keep."—*from "A History of Montana" by Helen Fitzgerald Sanders, 1913*

Another Step Toward Gun Control?

I've just read "Hunter Education" in the Nov./Dec. 1977 *Montana Outdoors*. I disagree entirely with the idea of enacting "legislation that saves lives and makes hunting a better sport," which is expressed in the mini-editorial accompanying the article. The only thing accomplished by passing legislation like this is that it would make a lawbreaker of the person carrying a loaded weapon in his or her auto. It would do nothing toward making guns or hunting safe. The people killed last year probably thought their guns were empty. A person's car should be private property, I think.

Safety around guns (or anything else, for that matter) has to be part of a person's upbringing. It falls more in the realm of hunter education than "gun safety" legislation. Gun safety is a personal question, not something with which the state legislature has to become involved. Hunter education for safety—yes; but legislation—no. A situation may arise where personal safety depends on having a loaded gun in the vehicle.

We lived in Montana for five years

recycled paper

and loved the state. I would not call Montana a liberal state. I always figured it was a state where a person had more personal freedom. That's what America is all about. I would far rather have my personal freedom and take care of my own safety than leave it to the government to decide what is and isn't proper gun safety for me.—*Robert Goodman; Ketchikan, Alaska*

*****

Please cancel my subscription to *Montana Outdoors* as of the date you receive this letter. Your mini-editorial in the Nov./Dec. 1977 issue on casing and unloading is another example of an appointed official deciding what's best for the public.

I have hunted in states where they have this law and I believe there are more accidents because of it! Anyone who would get into a vehicle with a shell in the chamber shouldn't be out hunting at all. Your article or law is just another step toward gun control.—*Merle Green; Anaconda, Mont.*

*****

This correspondence is in response to your recent mini-editorial in the Nov./Dec. 1977 issue of *Montana Outdoors* urging support for legislation requiring firearms to be cased and unloaded when in vehicles. You encourage hunters to support this legislation in the name of saving lives and making hunting a better sport. While I am sure most sportsmen would agree these objectives are worth-while, I seriously doubt if many would agree with your proposed method. It might do well for you to consider that careful handling of firearms by all gun owners will reduce "needless fatalities" regardless of legislative efforts. Such a program as you propose appears to be another example of "big brotherism" such as the motorcycle helmet law and interlocking seat belt systems which have found little support with the public.

Your characterization of concerns that such a law would be gun control as "nonsense" indicates a lack of understanding of the history of gun control legislation. It also appears to insult the intelligence of Montana gun owners who know full well that time after time legislation has been proposed in the name of public safety which would, if enacted, have the effect of further limiting the right of American citizens to keep and bear arms. Such legislation as that which you propose would have exactly such an effect. It would create needless inconvenience in the legitimate use of firearms, as well as limit the ability of law-abiding citizens to defend themselves and their property. It would also appear to violate another constitutional right: that of privacy.

I would like to suggest that your department reconsider its endorsement of thinly veiled gun control legislation and make a stronger effort to get in touch with the interests of Montana sportsmen—one of which is *not* gun control in any guise. Far from suggesting as you do that Montana is behind other states in the passage of such legislation, I would suggest that Montana is in the forefront of the resistance to needless and liberty-restricting gun control legislation.—*Steven A. MacAskill; East Helena, Mont.*

Update

The Wily, Wild Dog

Most stockmen like him best with his hide on a stretching board. But the coyote has almost nonchalantly expanded his range in spite of man's attempts to eradicate him.

The coyote probably has the worst reputation of all wild animals in Montana and few issues generate such strong emotions. Many ranchers feel so strongly they will do whatever they can to kill this wily, wild dog. On the other hand, some misinformed protectionists maintain that coyotes never kill domestic livestock and advocate complete protection. Some, who obviously haven't tried to match wits with him, have even suggested the coyote is threatened with extinction. In addition, many people are convinced that predators—coyotes included—are the sole reason we don't have unlimited supplies of many species of game birds or mammals.

Clearly, there is considerable interest in the coyote, so it is appropriate that readers be kept up-to-date on Dept. of Fish and Game research into coyote-big game interactions. (See "Coyotes and Game," March/April 1975 and "Coyotes and Deer" in the Nov./Dec. 1976 "Catchall.") Readers should keep in mind that this research is continuing, that all data collected have not yet been analyzed and that interpretations are preliminary and may change as more information accumulates.

This study was initiated primarily because coyote populations in many Montana areas were increasing when deer numbers were declining in many of these same spots. People assumed a cause and effect relationship and expressed concern that the department "do something" about the "coyote problem."

Our research comprises six study areas, one pair in each of three vegetation types: (1) near Miles City in the shrub-grass prairie vegetation type, (2) north of Bozeman in the mountain foothills and (3) near the upper end of Fort Peck Reservoir in the river breaks.

Briefly, objectives include determination of the following for each study area:

- relative status and trend of the coyote population—whether it is increasing, decreasing or stable.
- production, survival and recruitment (number reaching adulthood) of deer and antelope fawns. Figures compiled from ground and aerial classifications give the ratio of fawns to females (or adults in cases where antlers have been shed), as well as general population status and trend.
- relative population size and trend of rabbits through headlight surveys and pellet counts along established survey lines.
- small mammal (primarily deer mice) population densities and their trends through trapping (both live and snap traps) along established trap lines.
- timing and amount of deer and antelope in the coyote diet. To determine these, researchers will collect and examine all coyote scats they encounter. If possible, they will try to determine if the fecal remains contain either fresh kill or carrion.

Researchers have also collected coyote carcasses (from hunters, trappers, etc.) from the study areas as well as other parts of Montana to gain a larger sample of animals from which to obtain sex ratios, teeth for age determinations and stomach samples for determining food habits. Female reproductive tracts will enable researchers to determine both the percentage of females breeding and the average litter size by age class.

This information will be analyzed

and attempts made to correlate fawn survival and status and trend of deer and antelope populations with the status and trend of coyote populations on each study area. Information on rodents and rabbits is necessary because they form the bulk of the coyote's diet throughout the year. Coyote population levels are closely related to the populations of their small mammal prey—if small mammals are plentiful, so are coyotes.

However, alternate foods are important when they are more available, or when rodent numbers decline or are relatively unavailable because of deep snow or some other factor. During such declines or periods of rodent unavailability, some coyotes might switch to deer or antelope for sustenance. Once acquired, a predilection for these big game animals might persist even after small mammal populations rebound.

Researchers will collect data on each of the six study areas for two to three years. Then, one area in each pair will receive intensive coyote control, mostly through aerial hunting, with limited use of other methods. Most control will occur during late winter and spring, in an attempt to further reduce coyote numbers while they are at their lowest density. Control programs will be carried out for at least two years and data will continue to be collected on all areas. This will allow researchers to compare years of control and no control on an individual area, as well as compare controlled and uncontrolled areas within the same year. This should provide clues about whether intensive coyote control will benefit deer and antelope populations and, if so, under what conditions or circumstances.

Researchers initiated coyote control on one study area in late winter 1977. Control was delayed until March to allow hunters and trappers to take what they could while furs were good. This unknown but fairly substantial removal, combined with 15 coyotes taken by aerial hunting, resulted in a much reduced (60%-80%) coyote population through at least fall 1977. Additional data collected since then have not yet been analyzed.

Coyote carcass collection in winter 1974-75 and 1975-76 yielded data from nearly 900 animals. Sex ratios showed a slight excess of males each winter, which is similar to what has been recorded throughout the coyotes' range. Findings about coyote age structure and mortality rates fall into the range of normal for lightly hunted coyote populations. Still, the statistics might surprise many readers. In Montana, as elsewhere, adult coyotes (1 year old and older) experience a natural mortality of about *40% per year* even without any human-related mortality such as shooting or trapping. This means that four of ten adults alive one spring will die and be replaced by juveniles by the next spring (assuming a stable population exists) whether any control is carried on or not. Juveniles experience a higher mortality rate than adults and under these same conditions, only one of three pups born one year will survive to see his first birthday. Nature habitually overproduces by a wide margin and consequently also must kill a huge surplus whether man takes any or not. If this weren't the case, we would soon be overrun by all sorts of critters.

As human-induced coyote mortality increases, it largely replaces natural mortality. As mortality increases above normal (for example, through intensive control efforts), the chance for survival of the remaining animals is enhanced and they are usually in better physical condition. This leads to an interesting biological phenomenon. The remaining females have a higher reproductive rate, largely through a higher percentage of yearling females producing young; litter sizes also increase. A corresponding increase could be expected if more favorable environmental conditions ensued, primarily food abundance and availability. Likewise, the same processes work in reverse when conditions get tough.

In the collected sample, age structures included 40%-45% young produced the previous spring, confirming the approximately 40% adult mortality. Apparently, control efforts did not increase the overall, total mortality. Animals between 1 and 2 years old (yearlings) composed one-third of the total population in each winter. Thus, only one of four animals present in winter was approximately 2-½ years old or older.

Studies elsewhere show that in an "average" year, approximately 70% of the adult females produce pups, but only about 10% of the yearlings do so. With a normal age structure, only about half of all females in a population have pups. Despite this, enough pups are born to at least double the population.

Information from examination of female reproductive tracts showed that spring 1974 was a good to excellent year for coyote production. Approximately 80%-85% of both adult and yearling females produced litters, averaging 4.8 pups each. This high production rate probably indicates better than normal food supplies before and throughout the 1974 breeding season.

However, the following spring (1975), production was only average. Adults exhibited nearly identical production as the previous year (82% of all adult females produced litters, averaging 4.7 pups). But production by yearling females declined appreciably with only 24% producing litters, averaging only 3.6 pups. Since yearlings comprise a larger proportion of the population than any other age class, reduction in breeding by this single age class could result in only half the number of pups being produced by the same number of females. With even poorer conditions, almost no yearlings and a smaller percentage of adults would produce young and litters would be small.

After examining over 600 coyote stomachs containing food, researchers concluded the animals subsist almost entirely on mammals during the winter (November-March). Rodents and rabbits combined to form 42% and 53% of the total diet in the two years. Of the remaining volume, about half was cattle, one-fourth deer and one-fourth other species, including domestic sheep and antelope. Most, if not all, of the cattle were carrion, while the other species included both carrion and freshly killed animals in unknown proportions.

Deer appeared in the coyote diet in greater amounts in 1975-76 (11% of the diet in the overall sample) than in the previous year. Field studies indicated coyotes were killing a fair number of deer in at least two areas. Deer amounted to 25%-30% of the food volume in coyote stomachs from these two areas. Fawn survival to late winter (1975-76) was very poor and adult deer as well as fawns were lost

Springboard For Discussion

"Three years ago, almost all the calls we got about coyotes and foxes were complaints asking us for control. Now, most callers ask about markets, prices and skinning methods. The complaints that do come in are about illegal trespass by trappers, nonresident trappers, trap stealing, misuse of snares and claim jumping."—*Mike Aderhold, department information officer for the Glasgow region*

to coyotes. This suggests that although winter condition of deer was probably not very good, coyotes killed some deer that probably would have survived in the absence of predation.

Field studies in the Missouri Breaks documented 66 known or suspected coyote-killed deer in winter 1975-76. Most predation occurred along 45 miles of river and reservoir ice and adjacent bottom lands. Increased efforts to locate coyote-killed deer were made in winter 1976-77. Despite similar amounts of time spent on the ground in the area and twice as many observation flights (eight, versus four in the previous year) to specifically search for deer carcasses, only 20 suspected coyote kills were found. Fawn survival to late winter was also higher during 1976-77. Whether these levels of predation over an area this size negatively affect the year-to-year size of deer populations (which also suffer fairly high natural mortality rates) will hopefully be answered when the coyote control phase of the study is completed.

Food habits of coyotes during other seasons show they are extremely adaptable and switch to whatever food is most abundant and available. Far from being strictly carnivorous, they often eat things that contain little or no real "meat," and are not above switching to a vegetarian diet as different food sources become available and others become unavailable. For instance, invertebrates (mostly grasshoppers, but including crickets, large beetles, bees, etc.) formed roughly 40%-50% of the diet on all areas from about mid-July through mid-October 1975. Samples have not been completely examined yet for other years, so the extent of grasshopper use is unknown. However, where they are available, grasshoppers probably are an important food—especially for pups which are just becoming independent. Where available, fruits such as chokecherry and gooseberry were heavily used (25% to nearly 50% of the diet) during late summer and fall. Although it seems surprising, in some southern states, farmers suffer considerable loss in their commercial melon fields because of coyote depredations. Because of this adaptability, along with the high intelligence of the dog family, the coyote has persisted and even greatly expanded its range—in the face of man's strong persecution.

Another aspect of coyote-deer interaction under study relates to coyote predation as a possible factor in survival of newborn mule deer fawns. In spring 1976 and spring 1977, researchers captured and marked about 30 fawns in the Missouri Breaks. Most were fitted with radio transmitter collars which allowed the animals to be located at any time. The collars also contained a heat sensor which caused a signal change when the fawn's temperature fell below a certain point. This permitted researchers to locate carcasses as rapidly as possible after death—before decomposition or scavenging destroyed evidence of cause of death, especially whether they were predator victims.

Arnold Dood, a graduate student in fish and wildlife management at Montana State University in Bozeman, is now analyzing these data and results should be available in spring 1978. One thing that can be mentioned here is that roughly 30% of the fawns marked in each year were predator victims, all attributed to coyotes. Whether this level of predation is detrimental to the overall deer population is yet to be determined. However, since mule deer, especially fawns, experience a substantial natural mortality anyway, this does not appear to be an excessive level.

Researchers have captured and fitted 15 coyotes with radio collars in this same area in the Missouri Breaks. Movements, home ranges and possible interactions with deer and antelope are being studied. Most of these data are awaiting analysis. However, one interesting aspect of this portion of the study is the difference in movements between denning and nondenning adult coyotes for 1976. Ranges of two denning coyotes (one male, one female) averaged 2.39 square miles, while ranges of two nondenning coyotes (one male, one female) averaged 43.71 square miles.

Despite the controversy surrounding coyotes, Montana is in no danger of being overrun by them. In fact, all the data point to a more or less average coyote population in sex, age structure and food habits. Overall population levels and reproductive rates seem to be somewhat lower than those in many other sections of the United States. This is especially true when comparisons are made with the southwestern United States, where local densities may approach four to six coyotes per square mile.

This does not imply that coyotes don't kill livestock and/or game animals. We recognize this. And our research is trying to determine whether coyote predation deters the overall game population and, if so, when and under what conditions. Ultimately, we hope to determine whether coyote control can improve game animal populations and whether this can be economically justified.—*Philip Schladweiler*

Shed that old winter coat and get ready for spring with a subscription to MONTANA OUTDOORS

graphics. Judy Hoy

Please enter my subscription for:

18 Issues $8.00 ☐

12 Issues $5.50 ☐

6 Issues $3.00 ☐

Payment enclosed ☐

Bill me later ☐

New ☐

Renewal ☐

Please affix magazine label or enter name and address exactly as shown on magazine label

Name _____

Street _____

City _____ State _____ Zip _____

JA79

Mail to: MONTANA OUTDOORS, Montana Dept. of Fish and Game; Helena, MT 59601

Is there a BIGFOOT?

Since earliest recorded history and probably before, mankind has been intrigued with the unknown. No doubt, this characteristic has been an important guiding force along the uncertain paths from savagery to today's sophisticated societies. Scattered along these paths are fragments of almost-forgotten events and experiences taken form in deities, folklore, myth and legend.

Still, in the fabric of folklore and legend, there are tales of similar events that recur so persistently that the possibility of their being truth cannot be ignored. One such tale is sightings of man-like beasts. Recordings of man-like beasts roaming various corners of the earth date back many centuries. Some of the earlier and more persistent reports originate from the inhospitable climes of Manchuria, Tibet and Argentina.

Sherpa tribesmen of Asia have their yeti or "abominable snowman." Russia has its "wild man" of the Caucasus. Nearer home, the Klamath Indians of California have their "O-mah" or bigfoot. Legends of Salish Indians tell of the sasquatch (hairy men) inhabiting British Columbia, Vancouver Island and Washington as long as Indians have lived in the region.

Interest in such tales was rekindled in the English-speaking world by events that took place in the Himalayan Mountains during 1920. Mount Everest rises over five miles into the heavens from these rugged mountains separating northern India from Tibet. As an expedition approached the northern side of Mount Everest, explorers saw through binoculars a number of dark objects in a snow field high above. The objects appeared to move. When the party finally reached the snow field, it found a number of very large, human-like footprints.

Controversy soon separated skeptic and believer until eventually some full-fledged expeditions set forth to determine whether or not the fabled "abominable snowman" actually existed. Sir Edmund Hillary, a New Zealander of considerable stature and one of the first two men to conquer Mount Everest, was outfitted for an expedition into the Himalayas during 1954. Part of his mission was to determine if the snowman, or yeti, actually existed. After intensive investigation, which included scientific examination of objects purported to be portions of yeti, Hillary concluded the snowman was nothing but a myth.

In contrast, Tom Slick, who established the Southwest Research Institute of Texas, among other ventures, outfitted an expedition into the Himalayas during 1957. This expedition returned with what it felt was evidence the yeti did indeed exist.

The controversy continues. Fuel has been added to it in Montana with recent sightings of "ape-like"

creatures. For skeptics who consider the reports pure rubbish, there are some sobering facts to ponder. For example, consider that the coelacanth—an ancient fish believed by scientists extinct for some 70 million years—was brought from the ocean depths, alive and well, in 1936. The fish was discovered off the coast of south Africa and later near Madagascar.

In a remote area of China, the giant panda was the object of scientific search efforts for 70 years before one was captured alive. For centuries, Loch Ness, largest of the inland lakes of the British Isles, has been suspected of harboring some kind of strange animal within its gloomy depths. Reports of sightings date back to the 500s when St. Columba saw a "fearsome beastie" rise from its peat-stained waters. Of late, sophisticated camera and sonar equipment have added some credence to the legend.

Montana, along with Washington, Oregon, Idaho, California and British Columbia, has its share of bigfoot reports. From the Tobacco Root, Gravelly, Bitterroot, Sapphire and Mission Mountain ranges and from the mountainous areas between Helena and Choteau, over 200 sightings and other experiences have been reported. Many are too vague or incomplete for serious consideration, but others cannot be shrugged away. In several instances, man-like animals have allegedly been observed for several minutes at distances from 30-200 yards during daylight. In these reports, the animals were described as man-like, but much taller, with long arms, wide shoulders, no neck and covered with hair. In all instances, the creature or creatures reportedly walked upright on two legs, with long, smooth strides. In several cases, from two to twelve persons were alleged to have seen the creature at the same time.

Over 30 reports of individual sightings have been gathered from the area between Helena and Wolf Creek. Almost half of these occurred in an area along both sides of the Continental Divide from Rimini to Marysville. Another concentration of reports occurred in the Hauser Dam to Vigilante Campground area.

Not all reports are recent. Some from the Marysville area date back 40-50 years. Similar elements occur in the most reliable descriptions—a strong, sulfur-like odor; a smooth, almost fluid, athletic gait, and the fear stricken into dogs.

Existence of a man-like creature in Montana has not been proved to most people's satisfaction. Still, it's fair to say the possibility has not been disproved. Could such a creature live apart from man's social order, consciously avoiding contact with civilization? Or has man's imaginative and sometimes devious mind been projecting images that he subconsciously wants to see? Could Montana really have a bigfoot?—*Vern Craig*

Is there a BIGFOOT? definitely

MONTANA OUTDOORS: Is there a bigfoot?

DR. GROVER KRANTZ: In my opinion, there is a bigfoot, or, as I prefer to call it, "sasquatch." Actually, there's a population of them. They are a species of wild animal, a not-too-remarkable and perfectly normal part of the fauna of northwestern North America.

MO: Are there any in Montana?

KRANTZ: Yes. Their range is from the northernmost part of California through most of Oregon (at least the western half), most of western and northern Washington, at least the lower half of British Columbia, then down to the east and south through northern Idaho and the mountains of western Montana. Beyond that, I cannot be sure of the range. There are reports from practically everywhere in North America, but I'm very dubious about a lot of them.

MO: Do you have any feeling about the density of the population?

KRANTZ: I think there must be at least 200 of these creatures—males, females and young—because with any less than that the species would run the risk of extinction over a long period of time. On the other hand, if there were a population within this northwestern area of more than 2,000, I think they'd be hit by cars and logging trucks occasionally. So, my guess is somewhere between 200 and 2,000 for the Pacific Northwest, and my inclination is toward the lower end of that range. I think they are relatively rare. Another estimate would be based on comparing them with bears, and some evidence suggests a population of something like one sasquatch per one hundred bears.

MO: In Montana, we have had many bigfoot sightings, but we have had very few sightings during the hunting season when the most people are out in the woods. Can you explain this?

KRANTZ: In the first place, that surprises me because the collected information for the entire Northwest indicates a slight rise in reports during hunting seasons. Many animals take evasive action

then. Here, we're dealing with an animal that's more intelligent than anything in North America other than humans—I would say certainly smarter than bears. On top of that, I believe it's the animal with the best eyesight—certainly the best mammal eyesight. It would be fully aware of hunters and intelligent enough to know their patterns of behavior. If it chose to, it could avoid hunters more successfully than any other animal.

MO: What happens during the winter?

KRANTZ: We don't know. For the most part, the sasquatch has a behavior pattern fairly similar to the bear's. That is, it is a very large animal that requires a lot of food, moves at a modest speed and doesn't climb trees. Living in the northern temperate forest, the food supply is not tremendously large. Thus, it is dispersed, and it does not live in large social groups. So, with a number of strong similarities to the bear in feeding behavior, social groups and dispersion, we might guess that it has even more behavioral similarities to the bear. Some people have suggested it may store up fat and sleep through the winter. We don't know this for a fact, but, quite frankly, I don't know any other accounting for how it gets through the winter.

MO: Have there ever been sightings during the winter?

KRANTZ: Yes,but at a remarkably low frequency.

MO: How is it biologically possible to have a population of animals in the United States for this long without having a single specimen?

KRANTZ: Lots of reasons. A lot of people think we ought to stumble across the bones of one that died. But animal death can usually be divided into two basic causes: (1) animals that die abruptly and have no control over it and (2) animals that die slowly and do have some "say" in the matter. One kind of abrupt death is when an animal is killed by another animal and, of course, we often find skeletons. The animal that dies slowly—of old age, starvation, disease, etc.—probably doesn't know it's dying. But it knows it's ailing, so the animal will very deliberately hide itself, thinking it's going to recover. That means crawling into a cave, burrowing into vegetation—concealing itself as well as possible. These animals which die a natural death are rarely discovered.

"Aside from his big feet, what did he look like?"

courtesy of Western Outdoors

I've talked to many bear hunters and guides and not one has found a bear that died a natural death. So you wouldn't expect to find a sasquatch that died a natural death. The odds are that after we find a hundred bears, we should expect to find one sasquatch. Well, we haven't even found one bear yet.

Next, its most active time seems to be primarily between midnight and a little bit after dawn. That's the least active time for people. Also, if somebody sees a sasquatch, he's usually so surprised that he's unable to categorize the thing he sees. Even if he has a gun, very rarely does he think of trying to shoot the sasquatch. Several of these people I've talked to have had guns, saw a sasquatch and had cool presence of mind. They have actually raised the gun, looked at the animal and then paused, thinking, "This looks awfully human." And then, at that moment, the animal disappears.

In spite of all this, I wouldn't be a bit surprised if somebody—perhaps several persons—have already shot and killed sasquatches. The odds are pretty low, but it could have happened.

I've also imagined what such a person would do if he went over and examined the body. Unless he knew about sasquatches, he would probably think that he'd either killed a valuable animal that belonged to somebody or he'd killed a peculiar human being. In either case, he assumes he's in terrible trouble, so the last thing he'd do is tell anybody about it. He'd cover it up and run. If such a person could relocate such a kill, we could get the bones and the search would be over.

MO: What about acquiring a specimen?

KRANTZ: It's almost essential that a sasquatch be brought in. This could benefit the species, even though the loss of one member might be a threat. There's another way of looking at this: We humans might be doing something already to threaten the sasquatch population by damaging its environment. If so, we're never going to do anything to correct this because the animals don't officially exist. But if we have a specimen, we'll know they exist. Then competent people will go out and study their habits and we'll find out if something ought to be done for their benefit.

continued

Is there a BIGFOOT? I doubt it

MONTANA OUTDOORS: Is there a "bigfoot?"

DR. W. LESLIE PENGELLY: It just doesn't seem reasonable. What they're looking for is an oversize primate which would have a tough time making a living in these northern climates. I can't imagine what these animals would eat or how they'd survive the winter's cold. After thousands of man-hours put in by hunters, loggers, berry pickers, etc., nobody has come up with any real substantive answers. So I must say that the odds are against the existence of such a creature.

Bigfoot is in the same class as unidentified flying objects and I'm a traditional skeptic. My instincts tell me they do not exist and there is nothing in my scientific background and training to tell me they do. I have no need to create a bigfoot and I'm a nonbeliever in that sense. I have been amazed at all the things that have occurred in the natural world, but this is one I can't believe. Man originated or evolved in a very warm climate—probably in Africa—with food sources that were year-round. But to come into these northern climates and attempt to make a case for its existence seems ludicrous.

MO: What do you think these people are seeing?

PENGELLY: It could be blobs of snow that fall off conifer trees that they identify as tracks. Or a track of a bear that enlarges as it melts. A bear standing upright might be mistaken by a person with a keen sense of imagination, but not by a trained observer. I think some people see what they want to see. If people shoot a man out of a tree because they think they are seeing a bear, they can imagine seeing a bigfoot.

MO: Why have we gone all these years without finding specimens?

PENGELLY: We find remains in caves of saber-toothed tigers and even musk ox skulls. The primate skull is also fairly durable. I would think that if such an animal ever existed, there ought to be some remains somewhere, but no one has ever found any. There have been a few comedians involved in the farce—you may recall the character who made some outsize attachments for his feet and wandered around in fresh snow producing tracks for the guillible to marvel over.

MO: Are you in favor of spending money for research projects to find out if there is a bigfoot?

PENGELLY: Definitely not. I think there are far more valuable areas of inquiry. Bigfoot research is just a hobby or a fad. Spending public money on this is ridiculous. I have no objection to private funding if somebody wants to do it, but I can't see using public funds for such a poor chance.

MO: If somebody were out in the woods with a gun and thought he saw a bigfoot, would you recommend he shoot it so we'd have a specimen?

PENGELLY: No, for two reasons: First, it could be somebody dressed up like an ape. Second, there would be a good chance that some other animal—not a bigfoot—would get killed by somebody with a keen imagination. People frequently see things that do not exist, and I really think that's not a viable way to go. The recent release (Dec. 21, 1977) by the U.S. Fish and Wildlife Service spoke to that issue. It doubts the existence of such a beast, but added that if any were found, they would be placed immediately on the endangered species list. Then the National Guard would be called out to protect them, since it would be illegal to kill or capture bigfoot. ■

Next Time

Watch for these features in the May/June 1978 issue of *Montana Outdoors:*

Edible Wild Plants. Kim Williams, author of a recent book on this subject, provides a few hints on how to get started and recipes for enjoying the forage you bring home.

Water Ouzel. Ken Walcheck describes this unusual Montana bird as a "living symbol of environmental quality."

Vital Statistics. Bill Phippen has gathered a wide array of interesting figures about the Dept. of Fish and Game.

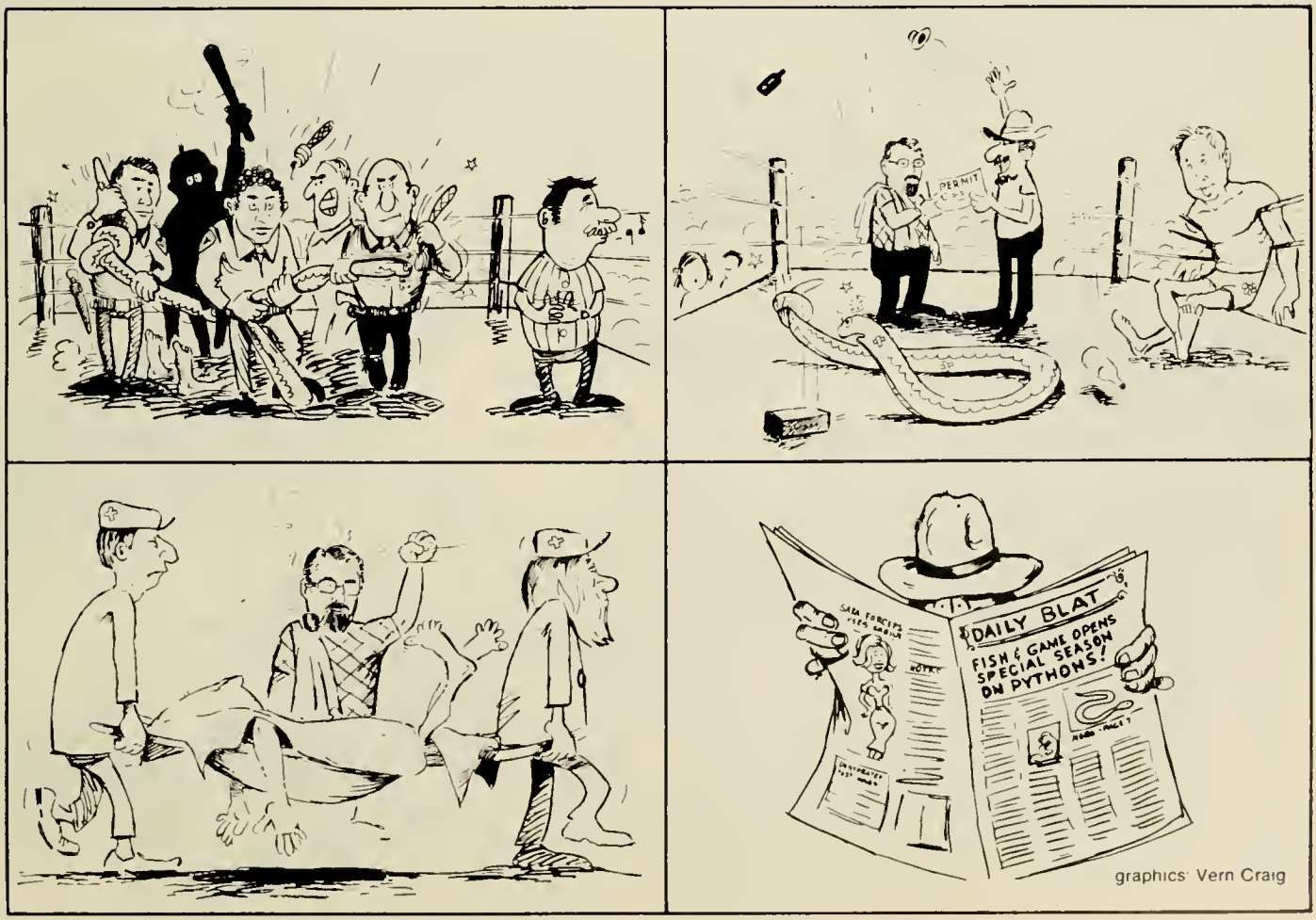
Montana's Greatest Wealth. In a guest editorial, Lt. Gov. Ted Schwinden urges that we act with wisdom and prudence to preserve the Yellowstone River and its many uses.

Catch and Release. Ron Marcoux discusses the philosophy behind this controversial special fishing regulation.

State Fishing Records. Mike Aderhold reveals some of the behind-the-scenes stories that go with Montana's record-setting catches.

Snake Pit Receives Permit

After conducting a public hearing in Missoula, the Dept. of Fish and Game granted Tex Cordell a permit under the Roadside Menagerie or Zoo Act for his proposed Snake Pit development near Rock Creek, east of Missoula. In doing so, the department recognized the development would affect the quality of the human environment to a degree. However, the degradation was subject to laws administered by other agencies and could be regulated. The public overwhelmingly opposed the development but the department did not have the authority under the Roadside Menagerie or Zoo Act or the Montana Environmental Policy Act to deny the permit.—*Jim Posewitz*



graphics: Vern Craig

Tracking the Wild Ones

by Ken Walcheck
illustration by Larry Thompson

A WARM APRIL SUN basted a shale-covered slope as a wildlife biologist slowly worked his way up a steep, rust-colored butte. The ridge overlooked the rolling, dissected landscape of the Sioux Division (Long Pines) of the Custer National Forest in southeastern Montana.

When he reached the summit, the biologist opened the lid of a battery-powered radio receiver, pushed the toggle switch to "on" and turned the selector to channel two. Wearing a set of earphones, he slowly rotated a hand-held directional antenna in a horizontal arc. When the antenna moved through the southeastern sector, a series of pulsating "beeps" surged through his earphones. As he continued to rotate

the antenna, the beeps faded and then boomed again when he returned to the same sector.

The researcher was radio tracking an instrumented white-tailed deer trapped several months before and neck-collared with a battery-powered radio transmitter inserted into a pliable, plastic neck band.

The researcher was using a relatively new wildlife technique to supplement the traditional wildlife research tools of binoculars and notebook. In this instance, he was gathering information in an area under consideration for uranium mining. The monitoring of instrumented wildlife in the Long Pines represents just one example of numerous studies throughout Montana and the world using radio tracking to eavesdrop on age-old mysteries of animals.

During the early 1950s, an "ad" was widely circulated to wildlife biologists throughout the scientific world: "Help wanted—must work 24 hours a day doing monotonous, repetitious tasks subject to variable temperatures and environmental conditions. No lunch, vacations or time off."

Actually, researchers were seeking a more sophisticated way of monitoring the movements and

"Despite the technological achievements of the telemetric technique, one should not be misled into thinking it will always provide ready-made answers to existing wildlife management problems."

activities of various wildlife species. For many years, marking animals and observing them was the best available method for studying their movements. To date, researchers have tagged or banded thousands of fishes, amphibians, reptiles, birds and mammals with identifying numbers and accumulated a wealth of data about their movements. However, the technique usually furnishes only very limited (and sometimes biased) data on an animal's activities and travel.

About 1954, a new technique—biotelemetry—was devised. It increased the amount of information obtainable about animal activities and intensified scientific interest in radio tracking techniques.

Biotelemetry (derived from the Greek "bios," meaning "life"; "tele," meaning "far off," and "meter," meaning "measurement") is the technique of gathering information on the location and measurement of a biological condition, activity or function of an animal and sometimes transmitting the data to a distant observer.

Telemetry really started in 1948 with discovery of the transistor, but the new science did not get off the ground until transistorized radios became available.

The practical use of biotelemetry had to await just the right blend of biologists and engineers. Research biologists had been thinking about the technique for several years but were unable to put their ideas into motion. The basic idea of wildlife telemetry or radio tracking is simple. A battery-powered radio transmitter is externally attached, surgically implanted or force fed to an animal. Radio signals or "beeps" emanating from the transmitter reveal the location of the animal to a person equipped with the proper radio receiver and directional antennae.

This technique could have been employed several decades ago—except the transmitter would have been so heavy (and fragile) that only an elephant could have carried it. The general, practical use of telemetry had to await electronic miniaturization, which now allows manufacture of transistorized, miniaturized, battery-powered packages—light, small, and durable enough to be carried by most animals.

Cobert D. LeMunyan, a research physiologist then at the Medical Research Institute in Bethesda, Md., originated the biotelemetric technique in 1954. LeMunyan and his colleagues surgically implanted a telemetry unit about the size of an aspirin bottle into a woodchuck's abdominal cavity. The unit weighed seven ounces and "beeped" a signal that traveled 25 yards. Despite its limitations, LeMunyan and his associates were the first to hear an animal announce its whereabouts.

After LeMunyan's initial discovery, the science of telemetry sputtered and coughed for a few years before the working components started to hit on all cylinders. With current radio tracking systems, researchers have a tool that provides a tremendous addition to conventional methods of gathering quantitative and qualitative data on animal movements and activities.

Take Tom Mussehl's forest grouse-insecticide studies as a classic example. During a 1965-67 study in the Bitterroot National Forest of western Montana, Mussehl, then a game research biologist for the Montana Dept. of Fish and Game, found that telemetry provided some extremely valuable data for grouse-insecticide evaluations. During a 28-day pre- and post-spray period in 1966, 13 radio-tracked blue grouse provided 326 relocations. During the same time, only 15 of more than 75 banded, but non-instrumented, blue grouse on the same areas were located and identified by the conventional method of observation.

Mussehl's telemetered birds also provided some unexpected information for evaluating effects of various insecticides on forest grouse. Researchers discovered they could find pesticide casualties by tracking instrumented females to their nests. In addition, instrumented blue grouse were monitored after they were orally dosed with the insecticide, Zectran. Researchers could detect behavioral changes such as

lethargy, unsteadiness, head wobbling and violent wing-flapping spasms.

A HIGH DEGREE of sophistication has evolved in radio tracking hardware and techniques during recent years: transmitters as small as six grains (0.4 gram) with larger units weighing up to six pounds, a transmitting range of 100 miles to aircraft and 9 miles to a receiving antenna mounted on a vehicle and a solar-powered transmitting life up to six years. Attachment devices as sophisticated as transmitters are now being externally fitted to adjustable, expanding and waterproofed collars guaranteed to withstand scratching, chewing and predation.

Today, researchers are attaching transmitters to organisms as small as bees and praying mantises. Transmitters are harnessed to whale calves, implanted in rhinoceros horns, force fed to snakes and lizards, implanted in the chest cavities of elk, bolted to the backs of turtles, strapped around the necks of polar bears and other big game animals, taped to the backs of ducks, affixed to the center tail feathers of falcons and attached to flukes of killer whales.

Attachment techniques are as varied as the amount of biological information that can be monitored from a radio-tagged animal. For example, take the case of the California gray whale. For years, wildlife researchers have been trying to untangle well-kept secrets about the physiological activities and migratory patterns of whales. One of the main difficulties has been putting a harness on a whale. Why use a harness and not a telemetry implant? Most biologists reject the idea of harpooning whales

"A high degree of sophistication has evolved in radio tracking hardware and techniques during recent years...."

to attach radio transmitters because an injured whale does not act normally and, as a result, research is unreliable.

Kenneth Norris, research scientist at the University of California at Santa Cruz, designed a method of lassoing young, suckling gray whales, harnessing them with long-lived radio transmitters and then returning them to their mothers. Before the harness could be fitted on a young gray whale, Norris had to solve a more difficult problem. A gray whale attains about 60% of its full length in the first year, growing from a relatively small 14-foot youngster to about a 26-foot adolescent. The problem was to design an expandable harness that would grow with the whale. An ingenious solution to the problem was provided by a biomedical telemetry specialist. Here's how it works: The unfolding part of the harness is attached to a stout wire fed through a tube of putty. The wire is prevented from feeding all at once by the resistance of a button connected at the other end of it. Only the slow, steadily expanding pressure of the whale's body can pull the button through the putty, and only at a very slow rate.

Today, radio telemetry can provide information about an animal's speed and patterns of travel, its short-term activity patterns, its interactions with other animals and the intensity with which it frequents various parts of its range. Researchers can also glean considerable behavioral and ecological data from the tiny transmitters, such as more knowledge about social structure, communications systems, predations, mortality, territorial boundaries and home range utilizations. Physiological information may also be gained by monitoring miniature transmitters implanted in various tissues of an animal's body.

SINCE THE INCEPTION of biotelemetry, a wealth of data has been accumulated in the biological sciences. Specific studies using telemetry have erased certain concepts about animal movements and behavior patterns, modified others and suggested many new theories. The relatively new technique is producing some surprising information. For example: In North Carolina, biologists studying the behavioral patterns of alligators inhabiting a nuclear reactor cooling reservoir found that alligators congregate in the heated portion of the reservoir and remain active during the winter, while their counterparts in colder areas of the reservoir go into a semidormant state. In a telemetry study of the deer mouse in Pennsylvania, biologists discovered the conventional trapping-recapture method was wholly inadequate in recording the actual homing speed of this rodent. Manitoba researchers determined where polar bears leave Arctic ice wastelands and move inland. Recently, it became necessary to obtain behavioral, ecological and physiological information on the northern fur seal in the Bering Sea to predict effects of potential oil spills near its breeding grounds. Radio telemetry was the only technique capable of gathering such sophisticated data. In Montana, Merriam's turkeys and other fish and wildlife species are radio tracked to determine the impact of strip mining on resident populations.

Like radio transmitters, telemetry-receiving systems vary considerably in their specific use. The simplest is a portable battery-operated receiver with a directional, hand-held antenna which can detect transmitted signals. The animal's approximate location can be determined by triangulating (a method of finding a position or location by means of bearings from at least two known points) on the signal, or by obtaining a single bearing to the animal and then estimating the distance and location on the basis of signal strength.

This system was improved when mobile receiving stations were developed for ground vehicles and air-

For once, technology has benefited wildlife. The ability to quickly and inexpensively locate radioed animals, such as this cow elk, has greatly improved wildlife research. F&G photos: Mike Aderhold

craft. Such systems are extremely valuable when working with animals with an extensive home range, where long distances have to be rapidly covered, such as tracking migrating birds or when animals have small home ranges but live in remote or inaccessible areas.

Another modification that has worked quite well with sedentary species involves semipermanent antennae mounted on rotating masts. These antennae can be elevated, thereby increasing the receiving range of the radio signal. The receiver for each antenna can be situated inside a field station or mobile trailer from which biologists can monitor several animals at one time.

THE MOST SOPHISTICATED animal tracking system yet designed is the University of Minnesota's Cedar Creek Automatic Radio Tracking System which became operational in 1964. The system utilizes 104 receivers to track as many as 52 animals simultaneously. It utilizes large antennae slowly rotating on 100-foot towers and provides reliable data on the location and activities of animals in an area of about 20 square miles. Once instrumented animals are released within range of the system, data on locations and certain types of activities can be photographed. Computers analyze and store information as fast as it comes in.

Another technological breakthrough in biotelemetry occurred in 1970 when wildlife biologists Frank and John Craighead started tracking grizzly bears and elk, using the satellite Nimbus, in cooperation with the National Aeronautics and Space Administration. Expanded space vehicle tracking programs have been planned for numerous other wide-ranging wildlife travelers such as the wandering albatross, which flies thousands of ocean miles every month. Studying wildlife by satellite will, perhaps, someday provide answers to questions about the complex systems that regulate the physiological and behavioral activities of certain animals: By what internal compasses do sea turtles navigate over a thousand miles of open water to lay their eggs? What are the free-roaming migration patterns of certain whales now classified as endangered species? How large an area does the polar bear, the largest nonaquatic carnivore, roam in quest of its principal food, seal meat? The satellite system can provide information not only on daily movements of polar bears, but also data on respiration and other physiological responses under various circumstances. With such data, it would be possible to relate the activity of polar bears to weather conditions on the polar ice cap and thereby better understand how this animal survives the harsh conditions it regularly encounters. Perhaps some of this information might be useful in teaching man better ways to adapt to rigorous Arctic conditions.

Wildlife managers are now extensively using biotelemetry to provide answers to perplexing wildlife questions. A 1973-75 Idaho study conducted by Mike Schlegel, senior game research biologist for the Idaho Fish and Game Dept., investigated the causes of calf elk mortality. Schlegel instrumented 67 calves with transmitter collars. Each transmitter was equipped with a motion-mortality unit designed that when a transmitter did not move during a four-hour period, the signal changed from a broken irregular tone to a continuous one, thereby indicating a dead calf or a shed collar.

The study indicated predation, primarily by black bears, was the most important cause of mortality for calf elk in the Coolwater-Glover Ridge area of north central Idaho. Researchers attributed 25 of 34 calf deaths (74%) to black bears and the remainder to mountain lions and unknown predator kills.

An examination of bear-killed calf carcasses at kill sites revealed some interesting kill techniques. Bears always attacked using the uphill advantage. If the calf was taken in heavy vegetation, most physical damage occurred in the withers, with puncture wounds in the neck and head. In contrast, if a calf was caught in an open area, the hindquarters received the brunt of the attack with additional puncture wounds appearing along the neck and head.

Schlegel was also involved in a research project designed by Dr. Richard Knight, then of the University of Idaho, and H.R. Johnson, electronics specialist in Moscow, Ida. Researchers inserted temperature-sensing telemetric devices into the reproductive tracts of cow elk. The special transmitter was sutured to the vaginal wall and the elk's constant body temperature kept the transmitter from activating. When the cow elk gave birth, she also expelled the transmitter. The cooler air activated the unit. "It was hoped," said Schlegel, "that calving sites could be delineated and calves born dead or in poor physical condition could be detected."

The senior research biologist inserted "vaginal" transmitters in five cows during 1973 and '74. All expelled the transmitters during calving. Although the transmitters worked quite well, Schlegel found he was spending too much time monitoring and walking to the sites to find the units.

Similar telemetric devices have also been used with deer by researchers in Utah and New Mexico. Information may provide researchers with new insight into the sudden decline of deer populations in some western states.

FROM THE FORESTED MOUNTAINS near Butte, Mont., Terry Lonner, research biologist for the Montana Dept. of Fish and Game, unearthed some interesting movement data from radio-collared elk. The elk/logging study strongly suggests the "bull harem" concept may not be as well defined and static as previously believed. The concept, as accepted by many biologists, infers that during the

rutting season a bull will attempt to form a distinct "harem," direct its movements and defend it against all comers.

Lonner thinks the concept may exhibit more plasticity. He radio tracked a 2½- /3½-year old bull during the 1976 and '77 rutting seasons and observed that its average weekly movement was 4.6 and 3 miles, respectively. In contrast, eight instrumented cow elk in 1976 averaged only 1.8 miles between weekly locations for the same time period and remained in about the same area used during the summer or pre-rut season. The fact this bull was observed on several occasions with a "harem" should dispel the argument that he was a young bull unsuccessfully moving around looking for a "harem."

"Possibly," says Lonner, "bull elk during the rut are always on the move and looking for a receptive cow not strongly attracted to any one harem, or in realistic terms, a cow-calf group. When a bull is observed with cows and calves during the rut, this may well not be a group formed by him, but a group he just happens to be a part of at that time. He probably does try and protect his 'breeding stock' from other bulls but evidence is building that he doesn't herd it around and stick with it for a very long time."

DESPITE THE PRECISE DATA that instrumented animals have brought forth to replace guesswork and ignorance, telemetry has not been without its frustrations. Take the paddlefish, for example. Montana fisheries biologists have long wondered where the prehistoric senior citizen of the Yellowstone River spawns and with what success. Since industrial water withdrawals threaten to alter the normal flow of the river, the future of the paddlefish in the Yellowstone may depend on identifying these areas.

The first attempt (1973) to implant a five-ounce radio tag into the peritoneal cavity (a double-walled sac lining the abdominal cavity) of a paddlefish failed because the radio signal traveled no further than 25 yards. The short-range signal could not detect a migrating fish in a large, wide river such as the Yellowstone.

During the following year, biologists implanted a smaller radio tag in a "cavity" on the backside of the fish after removing some muscular tissue. Although the signal from this transmitter was somewhat stronger, it still was not suitable to track paddlefish. Researchers also noted something else a little unusual: The paddlefish's immunological mechanisms—similar in many respects to those of mammals—apparently were rejecting either the transmitter or the surgical stitching used to suture the incision. In a short time, the skin in the sutured area started to slough away. During the same year, biologists equipped 13 paddlefish with external telemetry units designed by researchers at the University of Minnesota. The units were attached to the fish by plastic harnesses. Then, other problems surfaced. One difficulty was the possibility the attached telemetry equipment might modify behavior. When researchers released the instrumented fish, they did not automatically run upstream to their spawning grounds. Instead, many headed downstream after release. Telemetry monitoring by personnel in a fixed-winged aircraft noted that most radioed fish were inhabiting large, deep holes near the release site. This suggested the instrumented fish were undergoing an adjustment period. Unfortunately, the harness design failed to secure the transmitter to the fish. Most of the units dropped off and the remainder became inoperative during the adjustment period. At this writing, the paddlefish spawning grounds still await discovery.

IN AN ECOLOGICAL STUDY centering on sharp-tailed grouse movements and activities in the coal fields of southeastern Montana, Bill Sullivan, wildlife biologist for Westmoreland Resources, found his sample size of 12 radio-tagged grouse was dramatically reduced after a relatively short time. Of 12 instrumented birds, one presumably died of shock, five were preyed on by avian (bird) predators, one radio was found in an unidentified predator's burrow, signals were lost on two of the birds and one unit became inoperative due to a broken antenna. Only two of the instrumented birds remained alive. Although the instrumented grouse's normal activities appeared unimpaired by the radio tag and harness, the white color of the transmitter may have made the birds more susceptible to predation.

In another study, Neil Martin, the department's wildlife manager for the Miles City region, found his careful attempts to track an instrumented sage grouse were continually frustrated. After precise triangulation, Martin discovered a signal coming from undergound. He was further dismayed to find the subterranean signal was not stationary, but constantly changed direction. Martin deduced that a predator, possibly a badger, had eaten the grouse and he was really tracking the predator with the grouse and transmitter in "gut transit."

"Wildlife managers are now extensively using biotelemetry to provide answers to perplexing wildlife questions."

William Cochran of the Illinois Natural History Survey also experienced trials and tribulations in research with thrushes. Cochran discovered the weight of the transmitter played a significant role in

behavior modification. Thrushes equipped with radio tags weighing three grams ate when released, but gradually lost weight during the study period. The urge to migrate was also lost. With a tag weighing two grams, thrushes migrated, but only under favorable conditions. When the unit was reduced to one gram in weight, the birds seemed to behave normally.

Recent advances in electronic components of implant biotelemetry enable researchers to ask a whole new set of questions about the physiology of a wild animal's muscle responses, body temperature, respiratory rate, brain and cardiac measurements and other selected responses. Implant biotelemetry is a technique for conveying information from within the body of an unrestrained living organism to a remote location, through a wireless transmission linkage. Essential parts include a sensor and transducer which convert the biological measurements into electrical signals transmitted by microtransmitters to a remote receiver. The implant may be located within a body cavity such as intestines, mouth or bladder, or inside internal or external body surfaces.

RESEARCHERS ARE MEASURING physiological responses in wildlife species throughout the world. From the grass land plains of Kenya, blood pressure of wild giraffes is measured to provide more information about cerebral circulation. Body temperatures of iguanas in the tropical forests of Mexico are monitored round-the-clock to determine activity patterns. In the pine forests of New Hampshire, researchers measure the metabolic rate (amount of energy [heat] released in the body in a given time after the breakdown of foods) from white-tailed deer equipped with heart rate telemeters. From the sage-covered plains of Wyoming, temperature-detecting telemetric units have been implanted into pregnant pronghorn antelopes.

Joel R. Varney and David H. Ellis, former graduate students at the University of Montana, designed a telemetering egg for use in incubating and nesting studies. The unit provided information about the relative amounts of time a golden eagle spent on and off the nest during incubation. The system consisted of a telemetering dummy egg, a loop antenna placed around the outside of the nest and portable receiving and recording equipment situated far enough away from the nest to prevent disturbance to the birds. The egg contained switch and timing circuits and three sensors to monitor core temperature, shell temperature and surrounding light levels in sequential, 32-second periods. Varney and Ellis found their telemetering egg could provide accurate, detailed temperature and nest attendance data at moderate cost, without the need for long periods of field observation.

Medical researchers are looking to such telemetry systems to give man a healthier, better life. Medical applications now include "radio pills" the size of a vitamin tablet; they are swallowed or implanted in a patient's body and detect everything from heart irregularities to the presence of infectious or other disorders.

Despite the technological achievements of the telemetric technique, one should not be misled into thinking it will always provide ready-made answers to existing wildlife management problems. The technique, like all wildlife management tools, has limitations. This is probably best voiced by Gene Allen, chief of the department's research bureau. Allen, in a personal communication, wrote, "Because of the greater sophistication and technological achievement of the telemetry technique, I believe biologists feel more free to take 'interpretive license' with the data than with other types of information. Also, just because the technique offers the potential of gathering very sophisticated types of data doesn't necessarily mean that we should.... In short, let's decide what information we need and then gear the technique to that end." Allen's comments really are not surprising in the sense that wildlife has been seriously studied only for a half century or so, while wildlife has existed for millions of years. We should be prepared to wait awhile for all the answers.

"Despite the precise data that instrumented animals have brought forth...telemetry has not been without its frustrations."

Despite its limitations, giant strides will probably be made in the area of biotelemetry within the next five or ten years. At the First International Conference on Wildlife Telemetry in Laramie, Wyo. in summer 1977, J.R. Tester of the University of Minnesota predicted a variety of innovations—some soon, others further away. Tester foresees a day when it will be possible to use an electronic system to monitor an animal's location, behavior and physiology, as well as the physical variables in the animal's environment. To date, no study based on telemetry has combined all four aspects.

"A hypothetical study," says Tester, "could include minute-by-minute monitoring and automatic recording of the location of an animal, including depth of fish, the ambient temperature and light intensity at the animal's location, information on whether the animal is active or resting and the type of activity being carried out and lastly, information on such physiological characteristics as heart rate, respiration rate and body temperature."

At a time when some of man's technologies are exercising questionable effects on the natural world, it is comforting to note that technical advances in biotelemetry may benefit not only man, but also wildlife. ■

used with permission of Montana Art Associates,
Box 1338; Whitefish, MT 59937

Ghostly Wanderer from the North

by Ken Walcheck

illustration by Takehiro Taira

DUSK QUICKLY STEALS down a country road powdered with a skiff of fresh snow, chills the air and darkens the eastern Montana landscape. A cottontail rabbit stirs in a shallow coulee bristling with patches of chokecherry. A snowy owl's powerful wings quickly flap as the snow-white predator swoops in on muffled wings and slams into the rabbit, black talons biting deep.

The owl has achieved such deadly precision after millions of years of nature's experimentations. Subtle mutations have equipped the avian predator with curved facial features that cup sound waves into large ear openings. A wide head which sets the ears far apart helps pinpoint faint sounds in complete darkness. The owl also possesses unique refinements in its internal hearing equipment which account for its amazing sensitivity to low intensity sounds. Downy tips on the feathers also eliminate the whirring sound other birds make while flying, enabling it to weave as silently as a shadow while swooping down for the kill.

During peak years of snowy owl migrations into the northern states, telephones ring and newspaper offices are flooded with calls from curious observers asking about the strange, white birds. "There's a big, white bird with brown splotches sitting in a cottonwood back of our place. It looks like it's wearing feather-soled mukluks," they'll excitedly report. "What kind of bird is it and where did it come from?" are common questions. Seeing a large, white owl with a 54- to 56-inch wing span in your backyard is hardly an everyday occurrence.

Chances are excellent a small article and perhaps a picture will appear in the daily Times, identifying this ghostly wanderer from the treeless Arctic regions as *Nyctea scandiaca*—the snowy owl. The article probably will also report that a food shortage in the far North forced the birds south. The story is actually far more complex than most readers realize.

Over two decades ago, scientists studying predator-prey relationships in Arctic regions began fitting an intricate puzzle together. After documenting hundreds of snowy owl observations, they began to piece together one of the most remarkable birth control plans ever discovered.

Observers noted that during a year of low lemming abundance, the male snowy owl's intricate mating dance—although impressive—was mostly ineffective in stimulating the female to respond. Few, if any, eggs were laid.

A different response was noted when the mouse-like lemmings were more abundant. Just like the previous year's performance, the male lifted his head, swelled his throat, elevated his tail in a weakly vertical position and jerked out several long, low hoots, while bowing violently each time he hooted. However, the male added a new prop to the routine: He danced with a dead lemming in his curved beak. At the end of the dance, the pair mated. The research team theorized that the sight of the dead lemming somehow stimulates the female to trigger certain hormones which initiate ovulation. That spring, two eggs were laid and hatched, but only one owlet survived, thus keeping the owl population in balance with the available food supply.

The following spring, a peak lemming year, observers noted the male had banked more than 80 dead lemmings around a crude, grass-lined nest scratched out of the thin soil on the rolling tundra. Further observation showed the female responded to the abundant food supply by laying a bumper crop of 10 eggs, all of which hatched, with all owlets healthy and rapidly gaining weight. The evidence suggested that the more food the female raptor sees and eats, the more eggs she lays.

About every four years, lemming populations peak. As if on signal, the small, furry rodents burst from their underground cities and swarm like a living carpet over the tundra. When certain saturation points are reached, massive numbers of lemmings die and the population is almost wiped out. Although scientists have studied this phenomenon extensively, they still do not know why it occurs.

During years of plenty, snowy owls show little urge to migrate south when the chilling Arctic winter begins. But when snowy owl numbers peak and the larder is all but empty, the great white owl leaves its treeless domain raked by icy winds and swirling snow and heads south searching for food. During southern excursions, owls have invaded large cities bustling with human activity, squatted on dormitory window ledges (to the delight of university students) and even descended on ships far at sea.

Fatigue, starvation and many other dangers plague the wanderers and few return. Some authorities estimate that about 20%-50% of the owls make it back to the Arctic tundra the following spring. This is for the best, as the predator and its food supply are once again in balance.

The lessons learned from the predator-prey interactions of the snowy owl and the lemming illustrate quite well that while predation can certainly be a controversial subject, it can also be one of the most poorly understood. In addition, as with many other species, it shows the population of the prey plays an important role in controlling the population of the predator, and *not* the reverse.■

Wildlife Needs You

National Wildlife Week

MARCH 19-25, 1978

JOIN AND SUPPORT THE
NATIONAL WILDLIFE FEDERATION
AND STATE AFFILIATES